Food Manufacture

Incorporating Canning, Packing, and Preserving

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Clinching.

AT LAST year's Canning Convention, at Birmingham, one of the most interesting of the subjects discussed was the clinching of lids on cans previous to passing them through the exhaust box. A short paper on this topic was read by Mr. Hirst—if we remember rightly.

In the case of canned fruits intended for export to the tropics the practice of clinching is to be thoroughly recommended, for it enables a relatively high temperature to be used in the exhaust box and it also enables the cans to be closed at a higher temperature than that ordinarily employed. A good temperature for closing is round about 160° to 165° F. It should be noted, however, that a long exhaust at, say, 165° F., gives better results than a short exhaust at 180° F., provided the temperature of closure is the same in each case.

Canned Fruit in the Tropics.

Under tropical conditions the contents of cans may suffer as regards colour, flavour, and texture. Green fruits turn brown, while red and purple fruits assume in time a dulled appearance. In the case of green fruits, it has been found that the colour is preserved better in plain than in lacquered cans. In fact, plain cans are recommended for packing gooseberries and greengages, and also golden plums and white cherries.

Flavour is liable to changes after five or six months' exposure to the high temperatures of the tropics. Stone fruits may turn bitter and in practically all cases a "cooked" flavour creeps in.

Excessive processing and handling of the cans may lead to actual breaking up of the fruit, but in the ordinary way the tendency is for the fruit to soften somewhat.

Cockle Canning.

"Cockles and mussels alive-alive-O!" was the refrain of an old Dublin song, and hitherto it has been the custom of the trade to sell these plebeian delicacies alive to ensure freshness. This will now be no longer necessary, as we learn from the Campden Research Station that a process for canning cockles has been developed.

As many of our readers will be aware, the Campden Station is run in conjunction with the Scientific Department of the Bristol University, and is the State advisory body to British canners. During 1932 it dealt with over 950 technical problems submitted to it. One of these was a request from the District Inspector of Fisheries at Swansea to study the possibilities of cockle canning. Investigations were made at the cockle beds off the coast of South Wales and in the laboratory; eventually a report on processes for de-sanding cockles alive and canning them was submitted. This may very well have a beneficial effect on the cockle fishing industry. Up to now the fishermen have been restricted to a limited area in which they can sell their cockles alive and fresh, but now the Birmingham iron worker, the Bradford weaver, or the Wigan collier will be able to partake of the fish as easily as the more favoured people who reside near the cockle beds.

Shelling Cockles.

We have not seen the report issued by Campden, as, for the time being, it is confidential—or, at least, supposed to be. Information, however, leaks out in a mysterious way! We find published information stating that, after being thoroughly washed, the cockles may be subjected to one of three processes in order to open them—viz., boiling in water for 10 minutes, steaming for 12 minutes, and retorting at 240° F. for 6 minutes. Boiling, although it enables the meat to be readily extracted, is not altogether satisfactory on account of the loss of flavour.

We would like to know if Campden has tried the addition of dilute hydrochloric acid or other chemicals to cockles in water to induce muscle relaxation and so cause them to open of their own accord. Such a method, re-

ported in one of our previous issues, has been found by American workers to be excellent for opening oysters.

Apparently it was found that hand shelling is to be preferred to mechanical method. Surely there must be something wrong here!

Mussel Canning.

There used to be a few canneries along the U.S. coast engaged in canning mussels. Whether they still exist we do not know. In 1909, Dr. I. A. Field described in Vol. xxix., *Bull. of Bureau of Fisheries*, the methods used for canning and pickling sea mussels. After being picked over by hand the mussels are cleaned by being rotated in a cage and the debris is washed away. "After this treatment the mussels are removed and rinsed off with clean water. They are placed in a chest and subjected to live steam for from 5 to 10 minutes, or until the shells begin to open. They are next emptied into shallow pans to cool, and the natural liquor which has escaped into the chest is preserved in a separate dish. As soon as they are cool enough to be handled, the mussels are shucked and the horny 'beard' removed, the meats and liquor being preserved in separate receptacles." The meats are packed in cans or glass. The liquor is filtered, brought to the boil, and 2 oz. of salt are added for each gallon. The containers are filled with the boiling liquid and sealed. Then they are retorted in the usual way.

Obviously the method summarised above is capable of improvement.

More Fruit Growing.

It appears, according to *The Times*, that the duties on imported horticultural products are having the effect of increasing home acreage and employment. The official returns show that during 1933 there was an increase in the orchard area of 2,100 acres. It will be remembered that in last year's October issue we commented on a net decline of 300 acres, and pointed out that it was likely that 1933 would show an increase on account of the import duties imposed. Some people delight in having the opportunity of chuckling, "I told you so"; an innate sense of modesty forbids any such indulgence on our part. The increase in orchards was mainly in Kent, where 1,300 extra acres are now under fruit. Gloucester, Worcester, and Essex increased their fruit acreage by 700, 530, and 600 acres respectively. When it is realised that fruit development requires relatively large capital—about £60 an acre—these increases are significant.

Italian Fruit.

At present the amount of fruit on the market is greater than the demand. In spite of the duties much foreign fruit is arriving—especially from Italy. If the English grower is to keep his home market he must be enterprising in the way he offers his goods to the buyer. He would do well to study the Italian methods of packing and grading. We have been most impressed at the attractive way in which Italian fruit has come on to the market. Plums and peaches, all sound and of dessert quality, wrapped individually in greaseproof paper, packed carefully in attractive trays, can be seen in the markets side by side with English fruit—big and little, soft and sound—all huddled together in a round basket. The appeal of the graded and well-packed fruit is irresistible and the English fruit farmer must learn this lesson.

The Uninvited Guest.

In the August issue we referred to the possible ravages to agriculture in this country by the Colorado beetle. Since then several have been discovered and identified in an allotment at Tilbury, and it is stated in *The Times* (September 2) that another has been noted at Spittal, near Berwick-on-Tweed. This was not in a potato field, but on the bowler hat of a man who was walking on the promenade!

The beetle is easily identified. It has a yellow back with ten black stripes and is about ½ inch long. The beetle has cost France many millions of francs in the eleven years since it was discovered there—conveyed, it is alleged, by the American troops. It was first discovered in France near Bordeaux, where many American soldiers were quartered, and was firmly established before its destructive properties were realised.

There are many people who thought that the orders made by the Board of Agriculture prohibiting imports from specified areas were too drastic, but in our view they were very necessary. The insect is not well known to everybody; and farmers, allotment holders, or any persons concerned in the growing or handling of potatoes would do well to study the coloured leaflet issued by the Ministry of Agriculture.

Honey.

This has been, as one would expect, an excellent season for honey, and lately beekeepers have been pressing supplies on local markets, with the obvious effect of reducing the price obtainable. It would be more to the interests of beekeepers if they would realise that while in July, August, and September there is always a greater supply than there is demand, if the whole year is taken into consideration more honey is wanted than can be produced at home, and foreign supplies are brought in. Beekeepers should regulate their output. There is no reason, because the bees cannot help producing more honey in the season of flowers and fruit than in the frosty days of winter, that

the keepers should send it all out at once. Honey will keep and will be more appreciated by the public when the autumnal cold and the November sore throat come along than in a heat wave in August.

Beekeeping is not the simple business some people seem to imagine. It requires skilled knowledge and expert manipulation, but with reasonable attention to such details as feeding and bee diseases, it can become a very profitable industry.

Sardine Canning.

An account is given on another page of American methods of canning sardines, as described in 1927 by Mr. H. R. Beard of the U.S. Bureau of Fisheries. It was on this basis that the Bureau carried out a series of investigations which resulted in their suggesting several ways in which customary practice might be improved; in fact, a new process was developed and patented.

Frying in Oil.

One of the conclusions reached was that frying in oil should be eliminated. The most serious objection is the bad effect it has upon quality. If new oil could always be used this objection would not be serious. When old frying oil finds its way into the can it imparts its disagreeable taste and odour to the fish. Frying removes oil, salt, and soluble extractives from the fish. It is also a laborious and expensive operation. For these reasons the Maine canners turned to other ways of preparing the fish, finally ending with the steaming process, which is really better than frying, although it is also unsatisfactory in some ways—*e.g.*, in respect of the high loss of valuable substances.

The alternative methods of brine cooking and raw packing were also studied, but the disadvantages attending their application are such that they cannot be recommended.

Drying.

However, good results might be obtained in packing sardines raw if enough water were removed from the fish before they were canned. It would, of course, be necessary for the customary long drying period to be shortened. In one respect the work on drying was not successful—a way to dry fish rapidly for the raw-packing process was not found, but it furnished the basis for a new method of preparing the fish for canning.

Beard's Process.

The researches up to this point clearly showed that the preparation of the fish for canning consists mainly in removing excess water and in getting the fish into good physical condition for canning. The process should add to the fish no objectionable foreign element nor should it remove valuable substances.

This led Beard to develop a continuous system in which the brined fish are conveyed on wire trays (flakes) through a cooker-dryer of the design shown digrammatically on page 333. Air heated to about 275° to 300° F. is circulated through this cooker at a velocity of about 2,000 feet a minute. The fish are cooked for about 15 minutes, the actual time depending on the size of the fish, etc. After cooking, the fish are cooled and then proceed to the packing department. The tunnel type of cooker and cooler may, of course, be replaced by the compartment type, in which the trays are arranged in tiers. The essential feature of the preparation part of sardine canning, according to this process, is therefore very largely a problem for the drying engineer.

It will be seen that Beard's system simplifies considerably the usual procedure in this class of fish canning. It is also claimed to give a better product. Variations can, of course, be introduced, such as smoking in combination with drying.

SO_2 in Dried Fruit.

Discussing the points in favour of SO_2 for preserving dried fruits, Nichols and Cruess (*Ind. Eng. Chem.*, 1932, 24, 649) point out that this particular preservative is important in the handling of dried apples, apricots, peaches, and pears. Although the harmful effect of this gas has been frequently insisted upon, evidence to support objections to its use in dried fruits is not forthcoming. In Californian dried fruits the SO_2 content varies up to 3,000 parts per million, pears requiring 2,000 to 2,500 parts per million to give the best colour and keeping qualities. The fact must not be overlooked that some SO_2 is lost on subsequent storage, while a considerable proportion is volatilised during cooking and preparation. It has also been established that sulphuring of fruits during desiccation preserves almost intact the original vitamins A and C content, for which purpose at least 500 parts per million SO_2 are needed. Evidence available leads one to the conclusion that the restrictions obtaining in some countries as to the SO_2 contents of dried fruits are unwarranted, and could with safety be removed. This would give a fillip to the Californian dried fruit industry by considerably widening its scope.

Vinegar Corrosion.

That bronze metal is corroded by vinegar is made apparent by some experiments by Mrak and le Roux, who have exposed a number of bronzes to the action of

cider vinegar (4·27 per cent. acidity as acetic acid) at 20° C. for 100 hours. The most severe corrosion occurred when the metal was exposed to the vinegar as a spray, and to a lesser extent in aerated vinegar, and to a still less degree when simply immersed in the vinegar. The extent of corrosion under any of the three experimental conditions varied with the type of bronze, but was particularly heavy with those containing lead. Of pure metals, tin is generally more resistant to vinegar than either copper or lead, but the presence of this metal in a bronze alloy does not impart any resistance to the attack of vinegar.

Sauerkraut Preparation.

Sauerkraut is prepared by allowing cabbage to ferment naturally in the presence of salt. Undesirable organisms are killed off by this fermentation, but their presence for any length of time influences the quality of the sauerkraut. The effect of pre-washing the cabbage has been investigated by Keipper, Peterson, Fred, and Vaughan (*Ind. Eng. Chem.*, 1932, 24, 884). It has already been established that the outer leaves of the cabbage contain a very large number of micro-organisms which are useless as far as the sauerkraut fermentation is concerned. It has now been found that, by washing, the number of the organisms on these outer leaves can be reduced by some 80 per cent. Further reduction by washing in chlorinated water could be effected, but the odour and taste of the chlorine were very persistent. Hence this procedure is impracticable. The washed cabbage contained a greater number of organisms after 3 days' fermentation (the peak point) than the unwashed cabbage, in spite of the larger initial quantity on the latter, while acid formation appeared to proceed in the usual way.

Kraut Flora.

With regard to the bacterial flora of the kraut, the cabbage contains a large number of non-acid organisms which largely disappear after 3 days. Then during early fermentation, low-acid tolerant organisms predominate (having the characters of *Leuconostoc mesenteroides*). Later, with the higher acidity, the more acid tolerant organisms come into play (*L. pentoacetus, L. cucumeris,* and *L. plantarum*). Where fermentation was carried out in barrels the yield of "good to fancy" kraut was 87 per cent. in the washed cabbage as compared with only 19 per cent. from unwashed material. The advantages of washing are therefore obvious.

Growth of Fungi.

In a recent paper by E. J. Moore (*Pharm. J.*, 1933, p. 536), the nutritional requirements of moulds are considered. For normal growth potassium is necessary and cannot be replaced by sodium. Phosphate also is required. Other essential elements are iron and sulphur, and with some of the higher forms, calcium. Magnesium stimulates growth, though probably not a necessity, as do small amounts of zinc, cobalt, nickel, and silicon compounds. In certain forms copper is tolerated by most ordinary moulds. As a rule moulds develop best in an acid medium.

Spice Oil Emulsions.

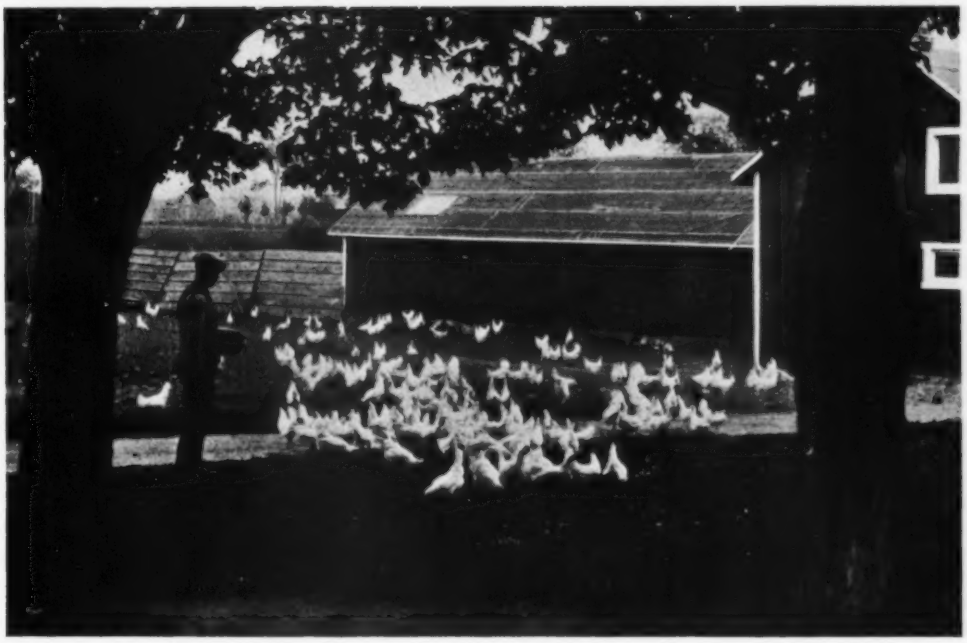
At the September meeting of the American Chemical Society, L. A. Hall discussed the use of spice oil emulsions for seasoning meats.

In the last few years, meat packers and sausage makers have been introduced to spice oil emulsions for seasoning their products, and up to the present perhaps 50 per cent. of the ground spices previously used have been replaced by these emulsions.

In the commercial practice of seasoning meats, it has been found that spice oil emulsions offer several definite advantages in contrast to the use of ground spices. If the seasoning is introduced in the form of an emulsion, the seasoning process is accomplished in less time and is more uniform. Also, the colour of the product is improved through the elimination of non-aromatic matter, such as starch, dirt, leaves, husks, etc., the result being a uniformly seasoned product showing only the natural colour of the meat. The objectionable black spots common to some sausage, which have been said to be due to the tannin in the ground spices, are also eliminated. Other advantages are presented.

Vitamin Dosage.

Reverting to the vexed question of the possible danger of an overdosage of vitamins, it is interesting to note a recent case reported from Edinburgh of a child of 18 months, which was admitted to hospital much under weight and unable to walk alone because of weakness. The doctors, at the time, diagnosed the ailment as kidney inflammation. The child died. It was later discovered that the boy had received a daily dose of irradiated ergosterol equal to twice the recommended dose. This severe dose was continued during the summer, despite the fact that he was living an outdoor life at the seaside. Examination of the kidneys showed large deposits of calcium. Vitamin D is supposed to help the body to use the calcium from the food. In the case of this child, the double dose resulted in calcium being deposited not only in the bones but in the kidneys. Death was attributed to too much vitamin D. It is unfortunate that neglect to stick to recommended doses should bring most valuable remedies under suspicion.



BRITISH POULTRY CANNING

A brief survey of technical and industrial developments by T. Crosbie-Walsh, F.I.C., F.C.S.

SINCE THE publication of the article "Some Preliminary Notes on Poultry Canning" in the December, 1931, issue of FOOD MANUFACTURE, a considerable amount of water has passed under the proverbial bridges, and many thousands of chickens have found decent and even ornate burial in cans, and instead of being, as was mentioned in the aforementioned article, "in the air," the British chicken canning industry is a *fait accompli*, and examples of its activities may be found in almost any grocer's shop.

Chicken is being canned in various parts of the country and in Ireland, and each pack has its own characteristic properties, but there still remains to be started a concern of any magnitude in the heart of the main poultry-raising districts.

The Bird.

The matter of the breed of chicken for canning is not so important as might have been anticipated. The usual breeds raised by the commercial egg farmer—viz., Rhode Island Reds, White Wyandottes, and Light Sussex—should pay the farmer to fatten for the cannery as a side line to his main activity of egg production. It is generally considered that White Leghorns do not pay to fatten, but the last word is yet to be said on this subject.

Both cockerels and hens are suitable for canning, but due regard must be given to the essential differences in the behaviour of the two classes of birds during their preparation.

The fat content of canned hens is large and that of cockerels very small. Thus the appearance of the opened pack will be widely different. The respective behaviour of the two classes of birds may be partially gauged by the following series of experiments.

In parenthesis, the data to be given may perhaps be considered by the "practical canner" as academic in its interest and alien to the proper activities of an industrial laboratory, but the author has held as an article of faith for many years that no single bit of analytical or other data that may be collated with reference to canned goods can fail at some time or another to be useful as a basis for factory practice or for the elucidation of the oft-times "mysterious" troubles with which the canner is beset. Scientific control does not only consist in the mere testing of the raw materials going into the pack and the testing

of the completed pack. In most industrial laboratories, however modest, it is possible to indulge in that pure research which is usually considered the province of the experimental stations.

The author would like to see a closer *liaison* between the industrial laboratories and the experimental stations.

There exists the terrible fear of the disclosure of precious trade secrets, but the danger is more imaginary than real, and in these enlightened days the tendency should be that of helpful collaboration.

With this digression the following data may be presented:

Two representative birds, (*a*) a Rhode Island Red cockerel approximately 14 weeks old and (*b*) a hen of the same species approximately 1 year old, are considered.

The birds were roasted and placed in distilled water in a standard can. The usual processes of exhaustion and sterilisation were carried out.

	Cockerel.	*Hen.*
Weight of raw bird in grams	834·0	818·0
Weight of roasted bird in grams ...	822·3	784·6
Weight of distilled water in grams ...	1,341·5	1,383·8
Weight of bird after processing (grams)	810·5	747·0
Fat separated from canned bird ...	3·5	26·0
Aqueous extract	1,305·0	1,365·0
Total solids in extract (per cent.) ...	2·75	2·10
Chlorine as sodium chloride in extract	0·09	0·075
Total solids in breast of bird (per cent.)	29·0	30·7
Fat in breast of bird (per cent.) ...	2·87	7·48

A further article, in which some of the implications of the above and other investigations will be discussed more fully, will shortly be presented.

In the meantime there emerges the fact that cockerels lose less weight in cooking than hens, and that this is not entirely represented by fat.

The presence of salt aids greatly in the separation of fat, and, in another experiment, the fat separated from a cockerel in distilled water was 3·93 per cent. less than that separated from a similar cockerel processed with 1 per cent. salt solution.

The effect of salt is enhanced in the case of a hen processed under the same conditions. No less than 6·26 per cent. extra fat was extracted.

Hens give out less gelatinous material than cockerels during processing, and due regard must be taken in adjusting the gelatine content of the pack.

Roast or Boiled?

These data are of prime importance from a practical factory standpoint.

In the previous article, quoted above, the author raised the question of the presentation of the bird. To quote, it was asked:

"In what form or forms shall he (the manufacturer) offer it? Shall he boil it and sterilise it and call it roast fowl? Shall he produce a roast fowl which may be taken from a can and heated up, if desired, to imitate as nearly as possible the fresh article, or shall he take the line of least resistance and make a mere galantine put into a pea can?"

In writing the above the author was presaging the possibility of producing a really roast fowl in a can, which suggestion has materialised, although most brands, English and foreign, still labour under the disadvantage of the wan, pale appearance of boiled chicken.

The Can.

The matter of the type of can is an important one. There are several alternatives. One may use the cylindrical can, involving greater space not occupied by the chicken itself, and therefore necessitating a greater volume of jelly with its consequent cost. However, the jelly itself should constitute an asset to the acceptability of the product, as it is well provided with valuable extractives of chicken meat and can be made into delicious *consommé* adapted to the requirements of invalids.

Oval cans require less jelly, and those conforming to the shape of the bird still less. The difference is the major extraction of the soluble constituents of the flesh of the bird in the case of cylindrical cans, but in actual practice the ordinary palate will not differentiate between the two, and, in the author's opinion, the additional advantage of having a considerable volume of excellent soup thrown in is to be considered, despite the fact that soup does not figure outstandingly in the *menu* of the ordinary honest-to-goodness middle-class household, which must buy canned chicken if it is to be made a national industry of any importance.

There arises the selection of lacquered cans *versus* unlacquered cans. Some manufacturers are putting up their product in the former and some in the latter. There exists in this country a marked "lacquer complex," due to the employment of lacquered cans for fruit and vegetables. This complex apparently lapses when it comes to sardines, lobster, salmon, and bully beef. With unlacquered cans there is an inevitable blackening of the can due to the evolution of sulphuretted hydrogen gas from the protein molecule during processing. This is not serious in the products to which the public are accustomed, but in a new product appears to produce a certain mistrust. Chemically considered, it would seem better to have the sulphuretted hydrogen taken up by the iron dissolved in the tin of the can than to have it slowly absorbed in the moisture of the pack and finally to be oxidised to sulphuric acid.

Bare tin appears to give the product a slight but characteristic bully-beef smell, but this on storing disappears. Unlacquered cans are cheaper. Lacquered cans may have the tendency to contain separated lacquer when packed with chicken. Fragments of lacquer, found in the pack, although innocuous to health, tend to produce distrust in the mind of the consumer.

However, the people concerned have devoted much time and research in producing a lacquer which will stick tightly to the can under the rather stringent conditions inseparable from chicken canning.

The type of tinplate composing the can is of utmost importance. In a non-compact pack like chicken the tendency will be towards the necessity of a heavier plate than required by a solid pack of the same size. Economy in this respect will prove to be false.

White Leghorns.
Male and Female.

Vacuum Packing.

There seems to exist a great deal of misconception among canners regarding the virtues and effects of vacuum, despite the clear and masterly articles which have been published from time to time on the subject. An excellent survey was given by M. A. Joslyn and E. M. Mrak in the October, 1932, issue of Food Manufacture. For all practical purposes, what vacuum achieves, whether produced by the exhaust box or the vacuum pump, is the proper collapse of the can after cooling. The more abstruse question of oxidation by occluded air may well be ignored by the practical canner. But it is rather pitiful to see exhaustion being practised and the cans being allowed to cool before closing, as if something permanent had been achieved by the passage of the can through the exhaust box!

Sterilisation.

Sterilisation is a difficult subject upon which to dogmatise.

Cookery book recipes are misleading and tend to lead to serious trouble. Every pack has to be studied on its own merits. The aim is to attain a sterile pack. It is the only safe plan. Large numbers of cans, perfectly good and passed by inspectors, show scanty numbers of *B. subtilis*, diplococci, and staphylococci, which are incapable of decomposing sterile meat. But there is always present the bogy of bacilli of the butyric series—anaerobes which resist ordinary treatment if they gain a hold. To a canning man who has been through the mill their appearance is always a potential menace! There exists, therefore, no such thing as safe sterilisation. Constant supervision must be exercised and routine bacteriological control is almost a *sine qua non*. Such bacteriological examination is neither tedious nor costly, and the initial cost of the necessary apparatus is not prohibitive.

Most people over-sterilise. It makes assurance doubly sure, but inevitably destroys some of the more attractive properties of the finished pack. A fair margin of safety must be aimed at, but visiting microbes are not always of the same microbic society and their point of extinction is sometimes difficult to ascertain.

Incubation, the experimental introduction of bacteria of known and ascertained resistance to heat, the use of electrical thermometers, are guides to satisfactory sterilisation.

A meticulous examination of "blown," leaks, and "springers" is advisable, with its consequent identification of the micro-organisms involved.

Jelly.

The choice of a jelly lies between gelatine and agar-agar. Some Continental varieties and also some British packs use agar-agar. It has the advantage of remaining firm at summer temperatures. A moderately strong gelatine will be liquid at 70° F. Gelatine gives a better-flavoured jelly, and may well be used for the winter trade at the right dilution. Due regard must be given to the relative proportions of chicken and jelly in the can. Chicken, in common with other flesh products, form a jelly from the collagen contained in them.

Commercial gelatine is very variable, and strict supervision is necessary to ascertain setting-points, *p*H values, etc. *p*H values are affected by the slightest variations in factory procedure.

Cooling.

Pressure cooling appears to have become almost universally favoured in this country. It certainly protects the cans and probably reduces the percentages of "leaks" due to straining. Unless the canner has sufficient plant to allow complete cooling in the retorts themselves a subsequent cooling is necessary, especially in the case of chickens. The chicken itself should be cooled as quickly as possible after retorting to a temperature of about 100° F.

By-products.

There is a wide scope for the treatment of the various by-products, and their utilisation forms an important part of the chicken canner's operations. Their variety is so great that a discussion of them and their preparation does not lie within the limits of the present article.

[*Photographs reproduced by courtesy of the Canadian Official News Bureau.*]

AT THE CONFECTIONERS' AND BAKERS' EXHIBITION

THIS year's Confectioners' and Bakers' Exhibition was well up to the standard of previous ones, and from the food manufacturers' point of view was worth visiting on account of the wide display of plant. The various exhibits impressed one with the almost endless devices to tempt people to eat; different varieties of bread and flour, cakes and biscuits, chocolate and cocoa, fruits, flavourings, colourings, together with a bewildering array of accessories to show off the goods—glassware, fancy shop stands, shop fittings, display cabinets, caterers' apparatus and cutlery. The sight of Christmas crackers on a hot September day was quite refreshing.

With regard to the machinery on view, in spite of the numerous exhibits of dough mixers, very few appeared to show much originality in design, though one feels that the potentialities of these machines are far from exhausted in the baking industry, and that they should find considerable application in the manufacture of cosmetics, pharmaceuticals, paint, etc. The only new piece of plant of general interest noticed was a combined sifter, mixer, and sprayer exhibited by Messrs. Wm. Gardner of Gloucester.

While the scientific literature of the cereal industry would lead one to believe that modern bread-making is rapidly becoming a matter of synthetic chemistry, there was a remarkable absence of the different salts of which one reads so much. Even in the matter of malt extract only 4 oz. should be added to 280 lb. of flour. It is interesting to note the wide range of fats employed in the modern baking industry, some manufacturers showing eight or ten different blends already prepared for their various requirements. There were several exhibits of essences and colours, but one representative expressed regret that some of his own customers had lost prizes in the competitions through not knowing when to stay their hand. This remark applied particularly to competitors from the North of England, and its truth was noticeable when viewing entries for the cake competitions.

While it was impossible to attend all the students' demonstrations in the Gilbey Hall, one was impressed by the keenness shown by the modern young baker and the fact that he is as alive to obtaining a full knowledge of his trade as were his forefathers.

The chief regret at the exhibition was that at the closing down of the Empire Marketing Board, and one cannot but think that the smaller Colonies, in particular, will now be unable to obtain such efficient service as was previously possible through the medium of the Empire Marketing Board.

THE CORROSION OF TIN CONTAINERS

AT the recent annual meeting of the Canadian Chemical Association, Dr. S. G. Lipsett read a paper on the corrosion of tin cans used as food containers, with particular reference to the packing of the more acid foodstuffs such as fruits (*Can. Chem. Met.*, 1933, xvii., p. 171).

He points out the anomalous behaviour of tinplate when employed for fruit packing, inasmuch as the tin appears to exert a protective action towards the exposed pin holes usually present in the plate. Further, lacquered cans frequently give more trouble than unlacquered cans, while the more acid fruits appear to be less corrosive towards the plate than those of less acidity. Experimental data are given which offer explanations for these phenomena.

With iron and tin in electrical contact under anaerobic conditions, as obtaining in the filled can, a reversal of potential occurs, the tin protecting the iron. Thus the tin will dissolve and the iron remain protected, and as the area of tin is relatively large to that of the iron, the tendency for the exposed iron spots to pin-hole through is remote. The potential between the iron and tin alters with the *p*H of the liquid contents of the can, and appears to have a maximum at about *p*H 4·0. This explains why more acid solutions—*i.e.*, below *p*H 4·0—have a less tendency to corrode. The tin removed does not all remain in solution, but combines with protein matter to form an insoluble compound, and the following figures are given showing the tin contents of various packed goods:

	Tin, parts per million.	
	Soluble.	*Total.*
Peaches	26	193
White cherries ..	49	103
Tomatoes	38	69
Gooseberries ..	40	105
String beans ..	18	79
Pears	40	120

Hydrogen formed during attack gradually replaces the oxygen, which latter is gradually used up. Swelling of the can due to excessive hydrogen should be distinguished from gases resulting from fermentive changes.

With regard to the excessive corrosion of lacquered cans, this is attributed to the relative areas of the metals exposed. With this type of can, when a break in the lacquer occurs, the iron and tin exposed may be considered of about equal area, and from experiments which have been carried out it is shown that under such conditions there is very active corrosion of the tin until the area of iron exposed becomes greater than that of the tin. Under this new set of conditions there is still active corrosion of the tin, but a large increase in corrosion of the iron. Finally, the protective action of the tin is lost entirely. It has also been shown that the lacquer film can act cathodically to the iron, and so induce corrosion of the latter metal.

SARDINE CANNING

The following account of sardine canning as practised in California is taken from a report issued in 1927 by H. R. Beard, Chief Technologist to the U.S. Bureau of Fisheries.

ORDINARILY 90 per cent. or more of the sardines prepared in California are of the so-called "pound-oval" pack. A can of this product usually contains four to ten large-sized pilchards, packed with spiced tomato sauce in a flat, oval can containing normally 15 oz., of which approximately 1½ oz. are sauce.

Small fish are canned in San Diego. They are usually put up with olive oil in regular key-opening "quarter-oil" and "half-oil" cans, holding 3½ and 7 oz. respectively. At times as many as twenty-five and as few as four fish are packed in quarter-oil cans, about eight to twelve being the usual number. The half-oil product is prepared from larger fish.

Other products are put out in small quantities. Half-pound oval cans are used at times for smaller fish. Other sauces placed in the can include (in addition to tomato sauce) mustard, souse (vinegar and spices), and soy for the orientals. Fancy packs are prepared by making fillets of sardines and by smoking to add the delicate flavour obtained in that manner.

The California industry is quite different from any other important sardine industry in the following respects: The pack consists for the most part of large fish in tomato sauce rather than small fish in oil. The can used is oval in shape and holds about 1 lb. of contents. Canning has been secondary in importance to the manufacture of fish meal and oil from the whole fish and cannery offal. The State law has never required the canners to pack all the fish they have taken. The liberal excess that has been allowed has been taken advantage of for the manufacture of these products. Inasmuch as there is more profit in the manufacture of fish meal and oil than in sardine canning, every effort has been made to expand this branch of the industry. To do this it has been necessary, in order to comply with the State law, to can more fish. To get rid of this canned fish the price has had to be lowered—low enough, in fact, to stimulate a large foreign demand, especially in the Orient, for pound-oval sardines. In some places this product has supplanted the cheaper grades of canned salmon; in fact, in 1925, for the first time, exports of canned sardines exceeded canned salmon exports.

I.—Preparation of Fish by the Frying-in-Oil Method

Sardines are canned in modern packing establishments situated on the water-front close to the fishing grounds. The size of the plants varies greatly. Some are able to handle only a few tons of sardines a day, while others can easily care for 150 tons in the same period of time. Most plants make extensive use of mechanical equipment.

The methods described here are representative of those generally used in California in the preparation and canning of fried pound-oval sardines. In this connection it is to be kept in mind that the methods given here are subject to considerable variation in the many canneries. These differences, however, are only different means of attaining the same end.

Description of a process is generally made clearer if it is treated according to the steps in which it naturally divides itself. This plan is used here.

Receiving.

The fish are shovelled from the boats into a mechanical hoist, which raises them to an elevated platform, where they are weighed. Water and gravity then carry the fish from the weighing vat into the cannery proper.

Scaling.

The first operation in preparing sardines for canning is to scale them. This is accomplished by passing them through a large cylinder of heavy screening, which is rotated in a tilted position. Most of the scales are removed by the rubbing of the fish against each other and against the screen wall of the cylinder. Water is sprayed upon the fish at the same time to help remove the scales and to wash the fish. The sardines next go to supply tanks, which discharge upon the cutting tables. In some plants the fish are scaled again after being cut.

Cutting.

Cutting is done largely by hand. In San Pedro all this work is done by Japanese women. Some plants

have recently started to use machines that are fed by hand.

The cutting operation by hand is carried out as follows: The fish is held, belly down, on the cutting board. One cut with a sharp knife is made almost through the body, well back from the head. A sidewise motion with the knife then tears the head portion from the fish, pulls out the entrails, and forces all refuse through a hole in the table. At the same time the other hand drops the "cut" fish into a bucket. The cutters do all this so rapidly that one can hardly see what they are really doing. The refuse from this operation goes to the by-products plant, where the oil is removed and the residue made into fish meal.

Brining.

In California large pilchards for the pound-oval pack are usually brined 60 to 90 minutes in 85 to 100 per cent. saturated brine. Each canner has his own preferences, and in the end each accomplishes more or less the same result. In general, the stronger the solution, and also the smaller the fish, the shorter the time needed for them to take up a given amount of salt. The real purpose of brining is to salt the fish. This step at times is omitted when the fish are canned in a watery sauce such as tomato, mustard, or vinegar. The sauce, if made salty enough, will in time impart its flavour to the fish. Oil does not do this. Brining removes some water from the fish and tends to make the flesh firmer and skins tougher, due both to extraction of water and to the coagulating effect salt has on proteins. Soluble proteins, especially blood, are removed to some extent, causing a loss of valuable food material. Removal of blood, however, tends to whiten the fish, and this is considered desirable. Brining probably has some preserving effect that helps towards keeping the fish in good condition until they are cooked.

Some data on the loss in weight brought about by brining are shown in the table given below. The loss in weight for large-oval sized fish in 100 per cent. saturated brine ran from 1·46 per cent. for 90 minutes to 2·94 per cent. for 240 minutes. Most of this loss unquestionably was water. Weber made an extensive study of brining and salting Maine herring. California pilchards undoubtedly behave in a very similar manner.

LOSS IN WEIGHT IN CALIFORNIA PILCHARDS, DUE TO BRINING (100 PER CENT. SATURATED SALT SOLUTION AT 64·4° F.).

Time (Minutes).	*Original Weight of Sample (Grams).*	*Per cent. Loss in Weight.*
90	980·6	1·46
105	928·3	1·47
120	980·5	1·95
135	938·8	1·95
150	964·3	1·97
240	964·3	2·94

Drying.

Experience has shown that some form of drying is necessary before the fish are placed in hot oil. Originally drying was done in the sun and wind, but now artificial dryers are used. Those used in the California industry, although they vary greatly in size and design, are all tunnel driers; so named because a long, narrow room or tunnel is used to confine the air that is forced or drawn through it. The air first passes over steam coils, then comes in contact with the fish spread loosely over wire flakes or belts. Some of these drying chambers are as large as 3 feet wide, 8 to 10 feet high, and 50 to 75 feet long, and handle as much as 6 tons of "cut" fish per hour.

The fish are usually handled on endless wire belts. One carries them to the top of the drier and drops them upon another which carries them through it. They then fall on a belt travelling in the opposite direction. A set of such belts, placed one below the other, repeats this operation several times before the fish leave the drier. In some driers but one long belt is used, and in others tiers of flakes containing the fish are wheeled on trucks through the chamber. This latter type of drier is used for fish that have been steamed and that cannot be tumbled about in the same way as raw fish.

The time of drying is controlled by changing the speed of the belts or the rate of putting in and taking out

The Sardine Cannery of Connors Bros. Ltd., at Black's Harbour, New Brunswick. This is claimed to be the largest of its kind in the world.

(By courtesy of the High Commissioner for Canada.)

Fishing Weir at St. Andrews, New Brunswick.

(By courtesy of the High Commissioner for Canada.)

trucks. Temperature is the other factor under control. This is regulated by changing the amount or pressure of the steam in the heating coils. Ordinarily the fish are dried about 30 to 60 minutes in air having a temperature of 90° to 120° F. and a velocity of 500 to 1,500 feet per minute, losing about 3 to 6 per cent. in weight in the process.

The warm air circulating about the fish removes the water and toughens the skins so that they will not break when placed in hot oil or when handled during packing. Although probably it is necessary for some water to be removed from the fish, the actual amount is of secondary importance. The drying conditions and the amount of water removed vary so greatly among canneries that it is evident that these factors are secondary to skin toughening.

Frying in Oil.

This step consists in submerging the dried fish (held in flat wire baskets) in a vat of cottonseed or other oil kept at a temperature of 220° to 260° F. (usually about 230° F.) for 7 to 15 minutes for large pound-oval and 3 to 10 minutes for quarter-oil fish. Frying is usually considered complete when the backbone can be pulled out easily and shows no redness. Considerable water is cooked from the fish. Much of this is vaporised, but some settles and mixes with the water under the steam coils, carrying with it soluble extractives from the fish. The heat also renders some oil from the fish, which mixes with the cooking oil.

The following figures show the losses in weight that took place in one cannery that prepared small oval-sized fish for canning. The calculations were made on the weight (371 oz.) of "cut" brined fish used for the experiment.

Drying 55 minutes, average air temperature 100°, and velocity about 500 feet per minute, 6·5 per cent.
Frying 9 minutes, average oil temperature about 230°, plus 9 minutes' draining, 7 per cent.
Draining 18 hours, 7·1 per cent.
The total loss was 20·6 per cent. This is larger than usual.

For large ovals the loss in various canneries probably will run around 12 to 18 per cent. In two experimental runs on frying oil, a total of 3,711 pounds of oval-sized sardines were cooked in oil 8 minutes at 230° and drained 8 minutes over the frying vat. The average loss in weight during frying was 7·7 per cent.

Cooking the fish destroys autolytic enzymes and partially sterilises the fish, so that under ordinary conditions they keep in excellent shape one or two days, and even longer, while waiting to be packed.

A cross-sectional sketch of a typical fry bath is shown in the accompanying figure. The baskets of fish are drawn through the oil by an endless-chain conveyor, or they are lifted in and out of the oil by hand. The oil is heated by means of steam coils placed in the lower part of the oil just below the place where the baskets travel. Underneath the coils (yet not touching them) is water, on which the oil floats. This water is placed there to take care of particles and body juices coming from the fish, as they, being heavier than oil, sink. The control of temperature is accomplished by regulating the steam supply. The speed at which the conveyor is run determines the time the fish remain in the oil.

At the start of a run the bath is filled with sufficient fresh cottonseed oil to cover the fish. Frying is continued in this same oil, sometimes for weeks, with such additions and subtractions as become necessary, until, in the judgment of the operator, the oil is no longer fit for use. It is then thrown away or sold as a low-grade oil. Judgment on the stopping-point is quite varied; the operator is influenced at times by the saving effected by prolonging the use of the oil. Usually, after a day of frying is completed, the oil is separated from the water and placed in tanks and the fry bath is cleaned. Daily (or at less frequent intervals) the oil is given some sort of cleansing treatment in some canneries.

Draining.

The baskets of hot fish coming from the cooking vat are stacked, several deep, on a truck and set aside to cool and drain until they are to be packed (usually next

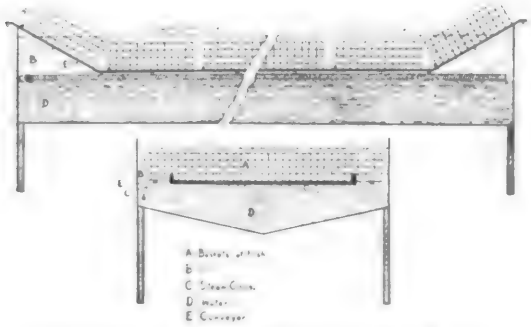


Diagram of a Typical Californian Fry Bath.

day). Stacked in this manner they cool but slowly, and this facilitates draining. Much liquid runs from the fish; some of this is oil, but most of it is water containing dissolved proteins. The losses of valuable extractions here and in frying are considerable. Upon standing the fish become firm and the skins are further toughened. The oil covering the fish tends to dry (in the sense that linseed oil dries) and this makes the skins tough and rubbery. This oxidation of the oil, however, detracts from its palatability.

Packing.

After sufficient cooling the baskets of sardines are placed on the packing table, where women discard the broken fish and pack the others into cans. These cans come through a chute from a different part of the plant to the packing tables. The filled cans are then placed on a belt conveyor, which carries them in a steady stream under a mechanical sauce distributor, which adds the correct amount of tomato sauce to each can. In some plants sauce is added to the cans before the fish are packed into them.

Exhausting.

Addition of hot sauce, followed by immediate sealing, is one way of warming the cans and contents and effecting the exhaust. Another method, more widely used, is to exhaust the filled cans by heating them with "live" steam for about 5 minutes. This heating usually is accomplished by conveying the cans through a narrow chamber into which the steam is turned.

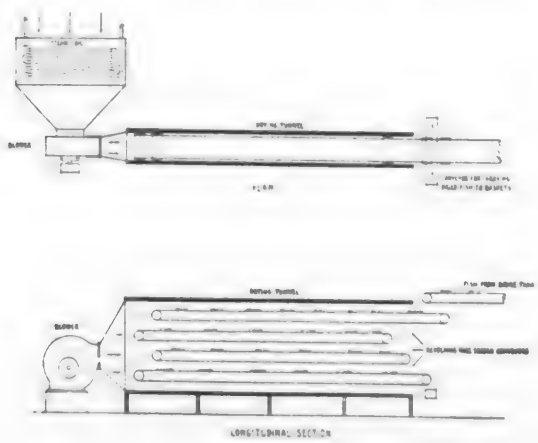


Diagram of a Typical Sardine Dryer.

Sealing.

The cans are conveyed from the steamer (exhaust box) to an automatic sealing machine, which places a cover on the can and then seals it on by the ordinary method of double seaming. In some plants the can is sealed in two operations—one machine just crimps the cover to the can and another seals the can after it comes out of the exhaust-box.

Processing.

Sterilisation of the contents of the cans is necessary to ensure their keeping qualities; in addition, more cooking is required to soften the bones. Proper heat treatment accomplishes both of these steps at one time. Trucks containing cans from the sealing machines are wheeled into large steel retorts, where the cans are heated with steam under pressure. Various temperatures are used. Usually, however, a temperature of 240° F. for 1½ hours is deemed sufficient. When the steam is turned off, the pressure inside the retort is maintained by compressed air until the cans have been partially cooled by water. This procedure prevents the cans from bulging, due to greater pressure inside than outside the can.

The cans are then washed in a cleaning solution and allowed to dry. In some factories the cans are next sent through a machine that lacquers them to prevent rusting. They are then placed in temporary storage for a few days, after which they are labelled, either by hand or machine, and boxed.

Quarter-Oil Pack.

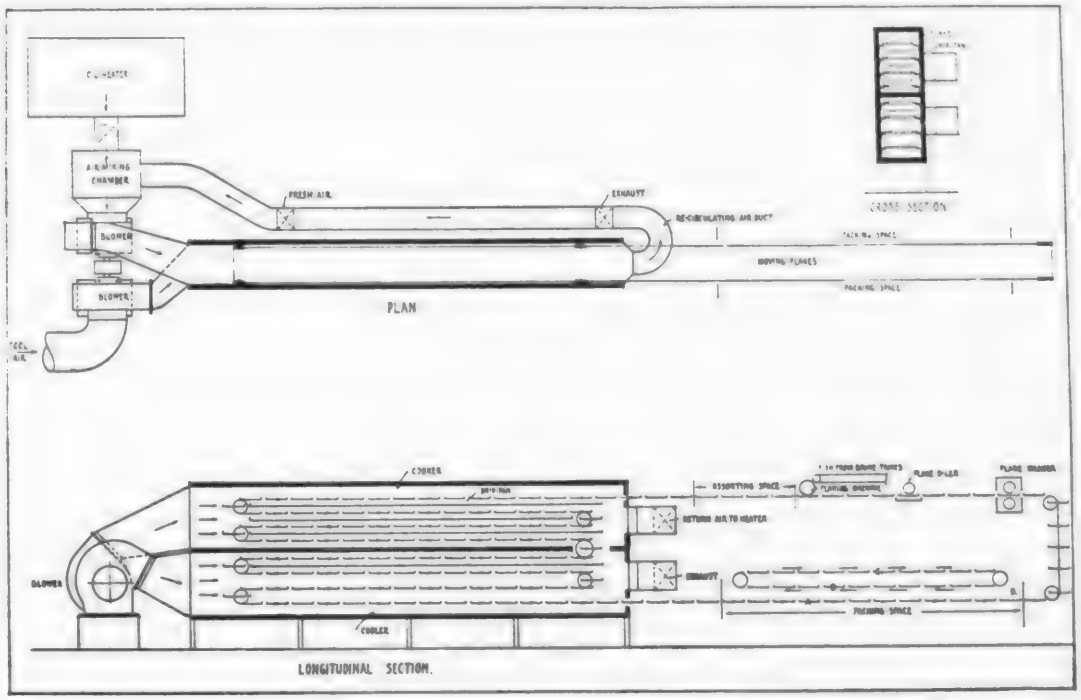
Small fish are prepared for the quarter-oil pack in the same general manner as large fish, except the frying time is shortened slightly. Quarter-pound cans are usually processed about 3 hours at 212° to 214° F. and half-pound cans 3½ hours at the same temperatures. Higher temperatures and shorter times also are used.

II.—Preparation of Fish by Ways Other than Frying in Oil

Instead of being cooked in hot oil, some fish are prepared by being cooked in steam or in hot brine. In the past some fish also have been packed raw.

Steaming.

Large-oval sized fish are cleaned, brined, and dried as for frying in oil. They are then spread on wire flakes. Since the cooked fish tend to stick together, they are placed so as not to touch each other. The flakes are next placed on a truck and wheeled into a retort or steam chest and cooked with steam under slight pressure for



Layout of Continuous System for Sardine Canning as Developed by H. R. Beard, of the U.S. Fisheries. This system was the outcome, as explained on page 323, of experiments which followed on the investigation of the practice in vogue at the U.S. canneries.

15 to 30 minutes. They are then removed and allowed to stand and cool, after which they are packed. At times the dried fish are packed raw into cans, which are inverted on wire flakes and steamed.

Brine Cooking.

This process is the same as frying in oil, except that the fish are cooked in hot brine and not brined before being dried. A saturated solution of common salt boils at 227° F. This gives a cooking temperature close to that ordinarily used for frying in oil.

Raw-Packing.

In this process the fish are brined, or brined and dried, then packed raw into the cans with sauce, exhausted, sealed, and processed. Results have been so unsatisfactory commercially that few fish now canned are prepared in this way.

III.—Maine Methods

The fish used is the sea herring (*Clupea harengus*). The supply for canning for the most part comes from weirs on the coasts of Canada and Maine. The fish are transported to canneries in watertight tanks or wells aboard the fishing boat. When placed in tanks at the weirs the fish are mixed with salt or brine, the amount being varied according to the size of the fish, and the time it will take for the boat to reach the cannery. Ordinarily about 200 to 500 lb. of salt to a hogshead (about 1,200 lb.) of fish is used. This salt brines the fish and also aids in keeping them in good condition. At the factory the fish are weighed or measured and flumed to storage tanks where they may or may not be brined further.

From the tank the fish are flumed to a conveyor, which carries them to a mechanical flaking machine. This machine spreads the fish quite evenly upon wire flakes. The flakes are placed in trucks and run into a steam chest, into which steam at a pressure of 80 to 100 lb. is turned for 8 to 15 minutes. The chests are not tight but are so constructed as to permit considerable escape of steam. The trucks of fish then go to a large drying room, where they are subjected to the action of warm air. Time, temperature, and air velocity vary greatly in different factories. Usually the time is about 60 minutes.

The temperature ordinarily used is about 100° to 120° F., and the velocity about 300 to 1,000 feet per minute. After drying, the trucks stand until cool. The flakes of fish are then given to the packers.

The packers now remove the heads from the fish with shears or pinch them off as they pack. The packed cans are placed on flat trays and cottonseed oil is added to them, a tray at a time, by an oiling machine. At times mustard sauce is added to the cans instead of oil. They then pass through the sealing machine.

In most plants quarter-oil cans are processed in boiling water for 1½ to 2 hours. Steam retorts are coming into use. After processing the cans are cleansed by shovelling them about in sawdust or by washing them with a cleansing solution.

Most of the packs consist of quarter-oils. Large quantities of the so-called "three-quarters" mustard packs are prepared. The preparation of this pack is virtually identical with that for quarter-oils. In fact, the larger fish seldom are separated from the smaller ones, all being prepared together. The larger fish are then packed in three-quarter cans (contents 10 oz.) with mustard sauce. These cans are processed about 2 hours in boiling water.

The process just described is the one used for "standard" goods. Fancy packs usually are fried in oil, as already described. These packs often are put in olive oil. Some fish are smoked also before being canned.

THE STORY OF THE VITAMINS

IN this book* Dr. Barnett Sure, who is Professor of Agricultural Chemistry in the University of Arkansas, tells the story of the vitamins in non-technical language and, generally speaking, succeeds in covering an extraordinary amount of ground in about 200 pages of easily read matter. A good idea of the scope of the work may be gained from the following list of chapter headings: The Discovery of Vitamins; Vitamin A; Vitamin B (B_1); Vitamin C; Vitamin D; Vitamin E; Vitamin G (B_2); The Vitamin Content of Foodstuffs; and The Rôle of the Vitamins in Health and Disease.

The account is, on the whole, exceedingly fair, though perhaps too much stress is laid upon Zilva's work on Vitamin C identification and not enough on the subsequent researches of other workers. It is strange, also, to note nowadays the use of the term "hexuronic" acid instead of the more generally accepted "ascorbic." However, these are perhaps only minor points, particularly when one realises how impossible it is for any such account to keep completely up to date when so much intensive work is being carried out on all sides.

The general plan, chapter divisions, and indexing are to be admired, and the book may be recommended to those who require an uncomplicated summary of the present position with regard to the vitamins.

F. V. W.

* *"The Vitamins in Health and Disease," by Barnett Sure, Ph.D Baillière, Tindall and Cox.* 1933. 206 *pages, including indexes. Price* 11s. 6d.

SAUSAGE QUESTIONS

Here are some of the questions which "Pork Packing" invites the sausage man to ask himself. "Pork Packing" is a book recently published in the U.S.A., and a note on its contents will be found below.

ARE all casings purchased being tested for strength, size, pinholes, warts, and stuffing capacity?

Are casings being soaked and flushed in cold water?

Are they being properly tied?

Are they being properly cut to length and stuffed to capacity?

Are they tied tight and punctured properly?

Are links uniform?

Is all casing and sausage waste going to the grease tank?

Are products hung so as to prevent touching in smoke?

Is sausage sprayed after being stuffed to remove the loose particles of meat?

Are stuffed products allowed time to cure and dry before going into smoke?

Are meats chopped the required time and kept cool in the silent cutter?

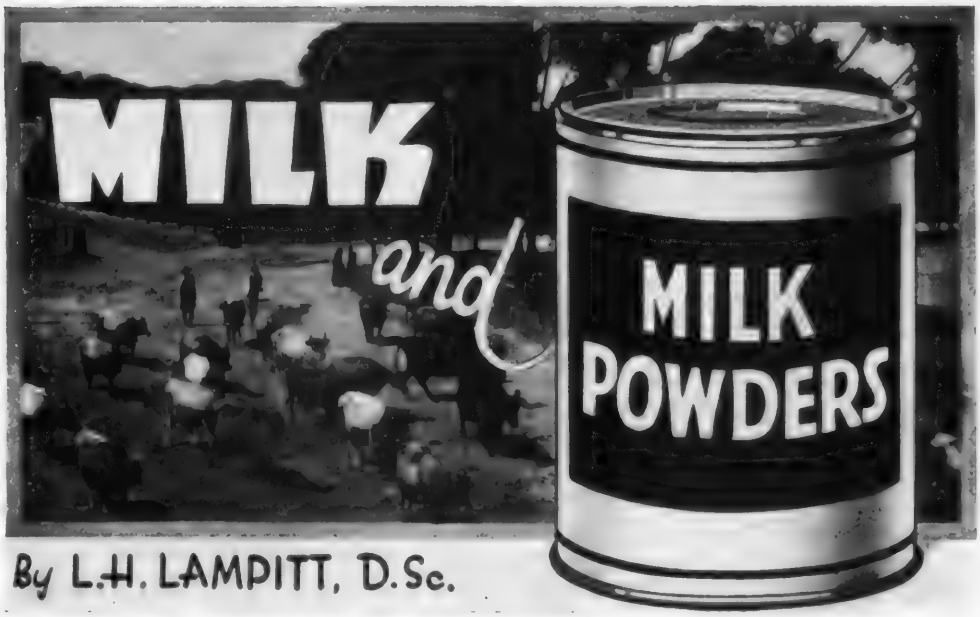
These are some of the questions; there are others to puzzle the brains of the small-goods maker, and in case of no intelligent replies forthcoming, answers may be culled from somewhere among the 360 pages of *Pork Packing*, recently published by *The National Provisioner* of Chicago as Volume II., revised edition, of the well-known *Packers' Encyclopædia*. It is described as "a test book for the pork packer and sausage maker," and has been compiled by A. W. Goedert and S. K. Maddux.

On the whole, *Pork Packing* is a useful book to the British packer. Anyone actually engaged in the business will find many points of interest. He will compare the methods and viewpoints belonging to another land with those which have grown up inside his own backyard, so to speak. Accordingly he cannot fail to profit from a study of the work.

The ground covered includes hog buying and killing, chilling and refrigeration, pork cutting and trimming, lard manufacture, curing pork meats, soaking and smoking, packing fancy meats, sausage and cooked meats, rendering inedible products, labour and cost distribution, merchandising.

It is not by any means a scientific work; it is essentially a practical handbook, written on the lines of the familiar *Packers' Encyclopædia*.

H. B. C.



By L.H. LAMPITT, D.Sc.

THE QUESTION of the relative merits of liquid milk and dried milk is the subject of a now comparatively ancient controversy; as space is limited it is not proposed to discuss the matter in detail.

However, at the present state of the development of the dried milk industry, the following can be said without fear of contradiction. Fresh, clean cow's milk, produced under the best conditions and consumed before it has time to deteriorate, is better than the best dried milk. How long this will be true it is impossible to say when the advances in the knowledge of drying made during the last generation are considered.

Looked at from the economic standpoint, there is no question as to the value—the important value—to the community of the drying of milk, which helps to conserve the summer excess for the winter's shortage and in a form which can be converted into liquid milk, milk practically identical with the raw material from which it originally came.

Another consideration of major importance is the distribution of the valuable food constituents of milk to those parts of the world where, through geographical or climatic conditions, dairy farming cannot be carried out on an economic basis, and where, as a consequence, milk in its original form is not available. The advantages are twofold, for, in the first case, dried milk assures the supply of milk to those quarters of the globe, and, secondly, the fact that whereas liquid milk contains approximately 12½ per cent. milk solids and condensed milk 30 per cent. of milk solids, dried milk contains about 97 per cent. milk solids; the advantage, therefore, from the point of view of freightage costs is obvious.

As it has been in so many cases, so was it with milk powder—the idea originated in the mind of an Englishman but the development took place abroad. It was Grimwade who obtained the first patent, a British one, in 1855, and although the product could not be called a "dried milk" with all that this term implies, his idea was to form the basis of an entirely new industry, and an industry which should develop in the course of a few short years into one of major importance to any dairying country.

For nearly half a century no notable developments in the drying of milk took place, but from the beginning of the twentieth century invention followed invention and patent followed patent until to-day the processes are multitudinous, and the resultant products, in some cases, are as far removed from the Grimwade powder in character and properties as is the modern liner from the sailing vessels of Columbus.

The ultimate aim of the manufacturer of dried milk may be one of three possible objects:

(*a*) To recover the solids of milk, no matter what degree of modification has taken place.

(*b*) To produce a "food" for baby feeding, for invalids, or for general use.

(*c*) To produce a "dried" milk; that is to say, a powder which on reconstruction with the requisite amount of water will yield a liquid which cannot be differentiated from fresh milk.

From a scientific point of view these form three advancing steps, and to a large extent the last has now superseded the first two, although it cannot be claimed that many of the numerous brands of milk powder on the market fulfil the necessary conditions, and many problems yet remain to be solved, notwithstanding the large amount of research work which has been devoted to the subject during the last few years. The fact that the raw material is a delicate biological liquid, the chemical and physical conditions of the constituents of which react to the slightest treatment, explains the failure to solve the problem. Milk powder is milk from which practically all the water has been removed, and consequently the replacement of that abstracted water should give a liquid

consisting of a complicated mixture of true solution and of colloidal dispersion, which has not only the chemical but also the physical attributes of the original milk. It is obvious that if any irreversible change takes place in the solids either during the drying process or during the period between dehydration and subsequent solution, the so-called reconstructed milk will not be identical with the original milk. Moreover, to satisfy the concept of dried milk as given in the third paragraph, the nutritive value of the milk solids must not be altered.

It would appear that lack of fundamental research work of a chemical character on milk powder itself may explain to some extent the slow advance of the last few years in the solution of those difficulties which have prevented the manufacturer of a full cream milk powder from achieving his ultimate object.

Flavour.

In this connection one of the outstanding disadvantages connected with full cream milk powder is its inherent proneness to lose its fresh flavour. When properly manufactured milk powder (produced on a spray drying system) in a fresh state is "reconstructed" (to use a common but particularly clumsy expression), it is almost, if not absolutely, impossible to detect any difference in flavour from that of the original milk; but, as is well known, progressive changes occur, with the result that the flavour becomes tallowy. The confusion which for a long time existed and to which I first called attention some ten years ago, has now practically disappeared, and talliness and rancidity are no longer used as synonymous terms. The theory of Holm and Greenbank that there is an optimum zone of moisture content for full cream milk powder, below which tallowiness is prone to develop and above which "fishiness" develops, requires more proof of general applicability before it can be definitely accepted. Actually the cause of the development of tallowiness is not known, although a number of suggested explanations have been put forward. It is not associated with any gross chemical changes in the main constituents, but the number of substances occurring in milk in small quantities is so great and the knowledge of them so little developed that it is impossible to correlate changes in any one of them with the incidence of tallowiness. Most workers have endeavoured to associate the deterioration of flavour with oxidation processes, and as it is limited to full cream powders, it is probably either due to modification in the fat itself or in a fat-soluble compound. The flavour of milk fat is supposed to be due to the lower acids of the fatty-acid series which occur in the glycerides of milk fat, and although the supposition is not based on very extensive chemical evidence, the fractional crystallisation of butter fat certainly results in the concentration, both of the flavour and of the colour, in the more liquid fractions; such separation is, however, unsatisfactory as a method of chemical investigation owing to the disturbing effect on the solubility of one glyceride of the presence of others. American investigators in particular find that the tallowy flavour of milk powder is the same as the flavour developed by the oxidation of the unsaturated oleic acid. However, the whole question is most involved, the progress of the oxidation hypothetical, and no definite work has been done which can satisfactorily explain the production of tallowiness; nor must the possibility be dismissed of the presence of an individual flavouring body (perhaps of the type of diacetyl) which by autoxidation or other action is destroyed, permitting the flavour of the glycerides to become apparent.

The deterioration in flavour is not, however, confined to full cream milk powder, for separated milk powder also develops an "off" flavour with keeping, a flavour which is generally described as "stale" or "chalky." It does not appear that anyone has advanced a theory regarding this change. It is not likely to be due to the small percentage of fat in separated milk powder (about 1 to 2 per cent.), as the flavour developed in full cream powder is entirely distinct.

The fact remains that this deterioration of milk powder is a major problem for the manufacturer which science as yet has failed to resolve.

Nutritional Value.

The question is often asked: What is the value of milk made from milk powder in comparison with fresh milk? And obviously the word "value" includes all those attributes of a more or less definite nature embraced by the term vitamin, those attributes associated with the mineral constituents, and those associated with digestion. Knowledge available regarding the last two groups is, at the best, scanty.

The important question might, however, be stated: How far does dried milk, when reconstructed to the normal concentration of cow's milk, deviate from the perfect food for the young calf? How far it deviates from the perfect food for the infant child is another matter entirely and one without the scope of this short article.

One step in practically all processes of drying is that of pasteurisation of the milk, and therefore the controversy which has raged around this question of pasteurisation must, *ipso facto*, be of equal importance in a study of the value of dried milk, and the stand made for pure, clean, raw milk cannot lightly be put aside. In fact, I cannot see that anyone can maintain that, assuming the possibility of supplying the nation with pure, clean, untreated milk, there is any argument in favour of pasteurised milk, but at the present state of development of the dairy industry such a desirable, almost ideal, attainment is *not* possible. And the decision must apparently rest between two evils. The choice should, of course, fall on the lesser; but who is to decide? At the present moment, surely, it can be said that the protagonists for both sides argue on unscientifically proven premises.

It is not possible in these few notes to do more than indicate one or two other problems of interest. It can be stated that as far as gross chemical and physical characteristics are concerned, reconstructed milk made from spray dried, full cream powder with a solubility of at

least 99·97 per cent., does not vary from those of fresh milk. But knowledge is gradually pointing to the fact that bodies present in minute quantities may seriously affect the normal course of metabolism; for example, reference may be made to the inorganic salt factor, and in particular the calcium phosphorus compounds. These have been studied in some detail, but without any definite decision as to the actual constitution of the calcium phosphates present. The complexity of the interaction between calcium and phosphates has been demonstrated in particular by studies on blood in relation to rickets, and the purely inorganic system [$Ca(OH)_2 + H_3PO_4$] proved to be intricate, the delayed precipitation of $Ca_3(PO_4)_2$ being a factor not recognised in earlier work, and one which is, in fact, of great importance in investigations of the system by electrometric titration methods. Moreover, the interaction is considerably affected by the presence of other salts, which in themselves are "neutral" to the action between calcium and phosphate. How far the state of equilibrium of the salts in milk is altered by drying is not known, nor has it been determined whether this equilibrium is of importance in nutritional studies. The whole question forms a fruitful field of study.

Studies on milk powder are hampered by the lack of knowledge of milk itself, and such knowledge as there is, is of limited value because most of the work has been carried out on samples of milk which are not average, or, if they are average, are average by chance and not by purpose. There has furthermore been very little done to standardise methods of analysis. Each worker has gone his own way, modifying methods adopted by his predecessors, and comparison between results, or the drawing of generalised conclusions therefrom, is rendered almost impossible.

The literature dealing with the digestibility of dried milk is particularly lacking, and precise knowledge of the comparative digestive rates of milk and of the powder made therefrom unavailable, if such studies have ever been carried out. Fragmentary experiments with dogs have shown that the course of digestion of roller process powder is entirely different from that of raw milk, while in the case of one spray process powder, at least, the course was found to be essentially the same as that of the milk from which it was made. During the last ten years or so the enzyme breakdown of caseinogen has received considerable attention, and a possible scheme has been lately drawn up by Stirling and Wishard which might, if applied to milk and the powder obtained from it, give some indication of the identity of this protein or protein complex in the two products. The rate at which phosphorus is split off during tryptic and peptic digestion may have an important bearing on the nutritional value of milk, particularly in the case of the young, and therefore the comparative study of milk and dried milk from this point of view may also be of decided value.

It is, however, certain that as the major physical and general chemical problems are overcome chemists will turn their attention to the finer and equally important, but much more elusive, difficulties connected with the ideal dried milk.

PASTEURISING

M. W. Yale, in *Technical Bulletin No.* 297 of the New York State Agricultural Experiment Station, writes that bacteriological studies of a high-temperature, short-time pasteuriser of an internal tubular type were made in co-operation with the New York State Department of Health. Two hundred and twenty-two samples of milk were collected during twenty-five pasteurising runs and examined by the standard agate plate count method. Comparisons between pasteurisation at 160° F. for 15 seconds and at 143° F. for 30 minutes were made on the same milk, both by laboratory and by commercial methods.

Pasteurisation by laboratory methods yielded counts which were lower on the average than counts by commercial methods. Pasteurisation at 143° F. for 30 minutes by a holder vat yielded slightly lower counts than pasteurisation by the short-time pasteuriser in 72 per cent. of the cases (13 out of 18) and an average count immediately after pasteurisation of 17,200 per c.c. for the former as compared with 20,600 per c.c. for the latter. These differences are so slight that they do not appear to be significant.

An average reduction in count of 58 per cent. occurred during storage for 24 hours at 40° to 45° F. of thirty-one samples of milk pasteurised by the commercial short-time pasteuriser. The average count of the bottled milk was 22,800 per c.c. before storage and 9,600 per c.c. after storage.

THE COLOUR OF HONEY

The colour of honey is usually associated with the mineral ash content, and although little data on the point is available, it is assumed that the darker the colour the higher the proportion of mineral constituents. In view of the importance placed on copper and manganese in dietary, Schuette and Remy (*J. Amer. Chem. Soc.*, 1932, Vol. 54, 2909) have examined a number of carefully prepared samples of honey, and have definitely established this point. Further, the darker honeys contain more copper and manganese than the lighter-coloured products. The following figures, being the averages of a number of analyses, serve as an excellent illustration of this point:

	Ash. (*Per Cent.*).	(*In Milligrams per Kilo of Honey.*) *Sio 2.*	*Fe.*	*Cu.*	*Mn.*
Light Honey ..	0·065	8·9	2·4	0·29	0·30
Dark Honey ..	0·173	14·0	9·4	0·56	4·09

OPPORTUNITIES FOR CANNING IN SIERRA LEONE

By A. H. Kirby, O.B.E., Director of Agriculture, Sierra Leone

Sierra Leone, the nearest of all our tropical possessions of outstanding commercial value, is virtually unknown except as a part of West Africa famed for its forest products, such as palm oil and cacao.

What of its resources for the production of other foodstuffs? Does it, for example, offer any opportunities for the canning and bottling of fruits and vegetables? If so, what is the best way of initiating industrial enterprise? These questions we have put to the Director of Agriculture, Mr. A. H. Kirby, and the following is his reply, based on an extensive and intimate experience of Central Africa. If the information he gives elicits interest and enquiries, no one will be better pleased than Mr. Kirby himself, for the Agricultural Department is able and willing to provide valuable assistance to all interested parties. The photographs reproduced are from the Collections of the Imperial Institute.

ANY CONSIDERATION of the possibilities of Sierra Leone must be made in the light of the fact that it comprises two areas with very different conditions and outlook: the Colony round the ports of Freetown, Port Loko, and Bonthe, with about 90,000 inhabitants; and the Protectorate, extending roughly north and east to French Guinea and Liberia, with a population of about 1½ million. Descended from freed slaves and other settlers of African origin, and added to yearly by immigration of the Protectorate tribes, the inhabitants of the Colony in the towns tend towards petty trading and clerical work, being largely supported indirectly by the palm oil and kernel production of the aboriginals of the Protectorate, although many of them, chiefly of Protectorate origin, are farmers possessing an instinct for the land that only requires development through sympathetic aid with a measure of control.

On the other hand, the 1½ million in the Protectorate are true farmers, growing their food (chiefly about 200,000 tons of rice and an unguessed-at quantity of cassava), selling or exchanging the surplus, and collecting the oil palm products. These people, holding their land in family tenure from the community, through their chiefs, have the agricultural habit ingrained in them through necessity and tradition. Like farmers in other parts of the world, they tend to be conservative—or shall we say cautious of changing what has served them well? But many of the tribes are amenable and quick to see the advantage of a crop with a good market that will bring them money. Witness the cotton and cacao growers of Nigeria; the ginger growers of Sierra Leone (who harvested 1,725 tons in 1932, of which 1,382 tons, worth £22,877, were exported); and, above all, the peasant of the Gold Coast, who has quickly come to be responsible for producing about a quarter of the cocoa crop of the world.

Fruit and Vegetables.

Dealing with the Colony first, there is no doubt that the natural conditions of the mountainous area in the west affords the best prospect for vegetables and fruits; while the latter, chiefly citrus and pineapples, grow well in the flatter lands. In these, where the rainfall is 100 to 150 inches during seven months of the year, with nearly five months of severe drought and often the trying, dry Harmattan wind during November to April, vegetables do not grow well during the wet season, because there is too much rain; nor during the dry, because there is little water for irrigation. It is the mountainous district, with simple irrigation during the dry months, that will produce tomatoes, etc.; while the prospects for citrus and pineapples are good everywhere. Only lately the Department of Agriculture has proved, with the aid of an importing firm in London, that the Colony produces a very good orange of the Brazilian type, that (like all tropical oranges) only requires artificial colouring to make it acceptable at home at good prices; while the Department's Experimental Fruit Farm at Newton promises to show similar results for grapefruit.

In the Protectorate, also, the writer's journeyings in every part except the north-eastern region have shown that areas of land suitable for tropical fruit growing can be found almost everywhere. One of the most striking of such areas lies south-east from the Colony Peninsula and between the main railway and the creeks (look for Gbangbama on the map), where Government servants of the past, apparently regarding their existence in the

country as more than a mere picnic, planted citrus and avocado trees that flourish and bear abundantly excellent fruit even now, in spite of years of complete neglect. There is evidence that the more delicate grapefruit, given care, would have been equally successful; for that produced at the Department's Station at Njala, about 100 miles along the railway east of Freetown, has proved to be excellent too.

Dealing with vegetables from the point of view of suitability of natural conditions in the Protectorate, many small areas can be found, preferably near the railway, where there is sufficient water for production during the dry season—the only possible time for really good vegetables. But these areas would have to be carefully chosen so as to afford many suitable sites within easy reach of the centre or centres for grading, packing, and canning, these in turn having to possess quick access to the railway.

On the Wharf at Freetown. A European Official directing Native Porters.

The Human Material.

The *entrepreneur*, with his agricultural advisers, needs to be something of a psychologist, for, as the most intelligent among the latter have come to realise, it is not mere experimentation that is required first in order to enable us to decide whether a proposed agricultural industry is likely to be successful or not. It is the human material that has to be convinced that it is worth its while to take part in the enterprise, upon which in the first place all the prospects of success depend.

Taking the Colony first, there is no doubt that the keenest among the farmers would welcome the opportunity for producing vegetables for canning and for employing their resources, increased in this way, for growing citrus, pineapples, and avocados for direct export and for canning (for the first two) as well. To help them they have the Newton Fruit Farm of the Agricultural Department at their doors for making available to them training, advice, and the best types of planting material. The attainment by these of success and a better financial position would quickly gain the practical interest of many in the Colony who, although they possess or have an interest in land, do not at present find the prospects of farming encouraging. This is particularly the case at the present time, with its conditions of stringency for everyone. Clerical employment has become hard to get and often impossible to retain, and trading is difficult to enter and at present prices brings little profit even to those already established in it. The result is that there is some movement "back to the land" fostered by the local press, which is at the present moment actually preaching the benefits of co-operation in farming and minor industries in the place of expectancy that Government can find nearly everyone a clerical or artisan's job.

In the Protectorate conditions are different. As already pointed out, we have here the born farmer, growing his food and collecting the forest products with the object of getting a little extra cash. Near the railway he is less unsophisticated; and it happens, fortunately, that it is here where a little demonstration in suitable areas of the kind already described, together with the distribution of free seed in the first stages, would prevail upon this type of inhabitant to turn the agricultural skill that he already possesses, almost from birth, to the production of vegetables in quantity. This is the way to use these people for this purpose; not by their employment as apparently cheap, but really costly, wage labour on plantations with expensive buildings and overheads. Their use for fruit growing is, however, a different matter, for it would be a long time before they could deal with the delicate re-

Sierra Leone: The type of country inland.

quirements of the more valuable citrus (although they would probably produce good oranges, pineapples, and avocados). There is ample room and labour and suitable conditions, in the Protectorate, for grapefruit plantations conducted on the most modern lines.

The Way of Approach.

Many of the farmers in the Colony have a little educational knowledge, and all of them have left their original tribal organisation in which the family may be called upon to act as a unit. This means that they have attained a certain degree of individual independence. Their great lack is funds to keep their land fertile and for employing labour; if they could be helped for these, with suitable safeguards, they would not be long in seeing the advantages of energetic attention to their farms. And many others would follow them who are at present precarious middlemen or small clerks but still retain an interest that would give them use of the necessary land. The obvious means of approach is therefore a marketing organisation which would begin in a simple way by encouraging them to grow vegetables, firstly for the local demand, through the distribution of seed and manures (no money, at any rate at first), and then by advances on crops and bonuses after export sales for paying balances due to them.

What we have said about population shows that there is plenty of demand for cheap vegetables; in fact, even in a poor year like 1932 the Colony spent more than £5,000 on imported onions alone; and it is upon this demand that there could be built up a vegetable industry both for canning and for export in fresh condition. With their increased wealth these farmers could be helped likewise to build up a fruit canning and export industry; for both vegetables and fruit there is a large local demand to provide a basis for action and for disposing at least not unprofitably of the produce below standard for canning or direct export.

In this way of approach the safest and quickest scheme would be to enlist the practical interest of the more influential of the Colony people (who usually possess farming land), employing local knowledge in order to be able to start with the most promising and trustworthy of the inhabitants. The ideal accompaniment and aid of all this would be an unlimited liability

Types of Native Agricultural Workers in Sierra Leone.

Entrance to Water Street Station, Freetown.
Note vegetables for sale on the extreme left and natives on the right carrying head-loads of produce.

mutual credit scheme of small societies, of the kind that has helped so successfully the small producer in many parts of the world. At every stage the assistance of the Agricultural Department should be available; in regard to fruit particularly, because, as already shown, it possesses an experiment station for supplying demonstration and advice, as well as the best planting material.

The way of approach in the Protectorate would be different. Here, with the exception of a small number of immigrants from the Colony, the farmer is of the tribal kind already described—largely a collector of produce who grows his own food. As we have seen, this region affords many areas where there exist adjacent small valleys or flat lands having perennial water for raising vegetables during the best time for them, the dry season; water that would be used at first by ordinary "watering," irrigation being possibly taught later, after carefully gaining practical knowledge of its effects. Such development would not interfere with ordinary farming; on the contrary, it would give occupation and means of profit in the dead season when ordinary crops are off the ground. In these areas, near the railway, the native farmer would be taught how to grow good vegetables by the Agricultural Department, through its existing system of demonstration substations and practically trained instructors; and the Department would, further, choose areas and superintend seed distribution, grading, and packing for the canning, marketing, and exporting organisations. The basis for this work already exists in the Department, which has now gained the confidence of the native through the close contact with him of its agricultural officers. These officers have won this confidence because they have been studying with his help the agriculture of the native farmer; they have not been hiding themselves in experiment stations, doing work that has very little connection with the needs of the country.

Although he would grow immediately excellent pineapples, suitable for both direct export and canning, the Protectorate native does not usually pay any attention to growing perennial crops, except kola, whose planting is done to a little extent by some while it is barred by others for reasons of fetish. His oil palm, piassava, and gum trees already exist for him, and he has only to collect their produce and give it the simple preparation that will get it on to the market. The Agricultural Department is, however, teaching him how to grow for himself the best kinds of oil palms and robusta coffee and cacao; and in time it may be possible to graft upon his intelligent experience of these, and even such highly skilled orchard work as the production of grapefruit. But there is much that we can do for him first.

A Market for Home Canned Products.

All that we have been considering has to do with exportation of canned and bottled products. Nevertheless, not only in Sierra Leone, but to a far greater extent throughout British West (and East) Africa, there is a growing demand for such among those products that this great area cannot itself readily produce—like tinned meats, fish, and milk. Thus, in the Colony proper of Sierra Leone, with its 90,000 people, either already sophisticated or becoming so, there is surely a valuable market in which to make a beginning. But a traveller through the whole country, interested in what is offered in the shops of all kinds, would be forcibly struck by the number of little "boutiques," not only in Freetown, but everywhere within easy reach of the railway, that offer European and American tinned provisions; and this is true of West Africa in general. It may appear to be a small matter that, last year, this country imported only £10,644 worth of these articles; but the quantity shows that this demand is made by many more than the comparatively small number of Europeans in the country, something like 1,500 in all. Again, as regards the Protectorate more particularly, although he may buy his ordinary food collectively and eat it in the same way, the indigenous African making his purchases in the shop is a very individual buyer, looking upon shopping as a pleasure, delighting to take a long time in making his choice, and prepared to give much time and trouble to getting for his few pence exactly what he has had and liked before. Then, too, his nature and experience do not lead him to save, to buy more cheaply for quantity or for a feast. It is for these reasons that his tinned food will be most attractive to him in *small*, gaily decorated containers that he can purchase singly as he wants them and happens to have the money and at a price that appears low to him.

Tin or Glass?

R. N. Wright, A.R.C.S., B.Sc., Factory General Manager of Crosse and Blackwell Ltd., discusses the respective merits of glass and metal containers for use in the food industry, in addition to providing an interesting note on food container costs.

HOW OFTEN one still hears the expression, "I never eat anything out of a tin," when engaging in a discussion on canned foods. For some peculiar reason certain specified articles, such as salmon and milk, seem to be exempt from the ban, but even nowadays one can perceive a certain irrational diffidence among old-fashioned people when one talks of canning such materials as cockles, brussels sprouts, chickens, meat and vegetable soups, and any of the "ready meals" which are daily becoming more familiar on the grocer's shelves.

The prejudice against tinned foods is fostered in the minds of its adversaries by occasional outbreaks of so-called "ptomaine poisoning"; a term which has confused, and appears still to confuse, the minds of both laymen and medicos. It is evident, however, that modern thought is relegating the term to its proper position, since the real issue—*i.e.*, the effect of bacteria or their specific toxins—is now being recognised.

Let us consider the problem of packing in cans or bottles from the manufacturer's point of view. He obviously is interested in costs in relation to the market in which he intends to sell and the volume of trade he will eventually build up for his products. Glass containers with their metal closures (caps and bands) are relatively more expensive than cans for equivalent capacities.

The Case for Cans.

Developments in machine construction have evolved can making plants which will produce units at speeds of over 300 per minute. Simple conveyor systems carry these units both to and from the filling stations at very small cost. High-speed machines are utilised for sealing the cans effectively and cheaply. Throughout manufacture the producer is dealing with a precision-made unit, and he is, therefore, able to set his filling machines, closing machines, and labelling machines to within very narrow limits.

One further point is that his standardised can, provided it is filled to the accepted filling height, will be correct for capacity.

The wise manufacturer will meet the requirements of his trade should they demand his products in glass containers, but he will also have to provide extra safeguards in handling and conveying these containers, particularly against breakage and consequent glass contamination. Special closures, usually of metal, will be required, and variations in capacity of the containers will need careful supervision to avoid increased production costs. Labelling and packing processes will also tend to reduce the speed of production because of the extra care required in handling the packages. Furthermore, should the producer be dealing with meat products—for example, soups—he will find that he will have to arrange for processing times and temperatures in his retort house with upper limits of temperature because of the possibility of breakage of the glass containers. Added precaution will also be necessary in fixing his methods for quick cooling after retorting.

The Appeal of Glass.

There is, however, a psychology of the glass container worthy of consideration, and many arguments can be deduced for maintaining that the glass jar or bottle is an ideal container for food and drinks.

The producer realises that attractively packed products sell to the eye and appeal to the palate. Through the glass the purchaser can see the pink and white of cherries, the deep red of plums, or the fresh green of garden peas. Many people select their food by its appearance rather than by its taste, and the manufacturer derives satisfaction in knowing that his product is selling because it is displayed with successful appeal.

The use of a glass container emphasises the importance of colour in food and drink, for the appearance of a food product is second only to its chemical composition in relation to its nutritive properties. Consequently, there is an æsthetic value to the problem of the proper use of colours in connection with the preparation of food which lends itself to an almost unlimited amount of development; but any manufacturer who intends to make use of colour should not employ it simply for making his pro-

ducts look better than they are; rather he must be certain that his consumer finds them as good as they are and as close to the natural product as is practically possible.

Labels.

Whether products are packed in cans or bottles, they must be labelled satisfactorily before they are sent out on the market. Glass packages with their contents readily displayed lend themselves to very effective and attractive labelling.

The producer of similar products in cans is faced with a difficulty in that he must in part rely on the habit of his customers to buy on the appeal of the label. In designing his label he would be wise to remember that certain colours are generally associated with certain flavours, if he decides to depict the contents of the can on the label. It is not merely a question of using brightly coloured labels; he must aim at a faithful reproduction of the contents and thereby strengthen "the appetite appeal."

Effect of Light.

There are several other interesting aspects of this problem in dealing with the relative advantages and disadvantages of packing in tin as against glass. For instance, products in tin are not affected by light; on the other hand, the transparency of glass to light produces numerous problems for the manufacturer. Labels, wrappers, cartons, and cases prevent the access of direct sunlight to some degree and thereby tend to reduce the deterioration of foods sensitive to light.

Coloured glass containers are used for certain products. The rate of rancidity of fats is reduced when they are held in green containers. Manufacturers, however, obviously prefer to use clear glass for their products in spite of this protective influence of green on light deterioration, as the green glass masks the colour or clarity of their products and lessens the appeal to the eye. The practical way out is to pack the light-sensitive product in the usual clear glass container and protect it by using a green cellulose wrapper.

Influence of Metals.

Products packed in tin containers are liable to incur some deterioration by reason of their contact with the metallic inner surface of the can. Some products are affected mainly in colour, as, for example, the bleaching of cream of asparagus soup or the change to yellow of the natural green colour of fresh peas. Protective lacquers are employed to prevent contact of such food products with the tin surface of the container and thereby preserve the original colour of the food product. Lacquered cans are, therefore, necessary when red coloured food materials, such as red fruits and beetroot, are being packed, and the lacquer used in these instances is entirely different from that used for products which tend to discolour as a result of the formation of sulphide compounds.

Several other food products, on long standing in tin containers, are liable to develop metallic contamination, particularly when the can is not perfectly "tinned" on the inner surface, thereby allowing attack by the material on the iron under the surface.

Fruit in plain cans does not cause very serious difficulty with regard to corrosion, as the corrosion is fairly evenly distributed over the entire inner surface of the can. With lacquered cans any corrosion which develops is usually confined to small areas where the plate has been subjected to the greatest strain in forming the can—*i.e.*, at the double seam at each end of the can and along the side seam.

The manufacturer is, therefore, faced with the problem of metallic contamination of his product when using lacquered cans if the tin is not perfectly covered with the lacquer, for there is a concentrated action of the food product on the minute surfaces of tin left exposed. Both tin and iron, when exposed, corrode more rapidly in a lacquered can than in a plain can. It sometimes happens that in relatively short periods there is exposed a greater surface of iron than tin. The iron then tends to set up local couples which result in the formation of hydrogen, the container becomes an unsaleable "hydrogen swell," and eventually "pin-hole" perforations of the can occur with consequent decomposition of the food product.

With glass packages the metallic area involved is almost negligible, in that it is only the under surface of the cap which needs special protection, and, in addition to using a suitable lacquer, it is the practice to add a further protective disc of waxed ceresin.

Some consumers prefer to buy glass packages because they fear that the salts of tin which may be found in canned foods are poisonous. Following extensive experimental work, both on animals and human beings, it has been shown that the potential danger of tin poisoning is negligible, for in one set of experiments metallic tin was administered in very large doses to human beings over a period of days, and no trace of tin could subsequently be found in the blood stream when the most refined analytical methods were applied.

Micro-Organisms.

Whether cans or bottles are used the producer is faced with the difficult problem of dealing with micro-organisms, those microscopic forms of life which cause spoilage in the form of flat sours and, in certain instances, cause the package to develop into a blown condition. Fortunately two groups—*i.e.*, yeasts and moulds—are sensitive to heat and are eliminated by treatment for a few minutes at 170° F.

The food producer's big problem is to deal effectively with bacteria, particularly when spore-bearing varieties of spoilage organisms are present. Bacterial spores being very resistant to heat treatment are the cause of heavy losses to the producer unless adequate time/temperature sterilisation conditions are employed; consequently, canned products can be more readily and advantageously dealt with than bottled products, in that more drastic treatment may be applied to them both in heating and

cooling without fear of loss from breakage of the container.

Tin or glass containers? It is an absorbing topic. Whole chapters might be written on some of its sections alone, and the problem opens up an interesting and wide field for discussion for all who are engaged in the canning industry.

Food Container Costs

The tendency in the industrial world to-day is for the control of productive organisation to gravitate towards the scientifically trained and technically skilled manager, who is able to digest, interpret, and act upon the various accounts which are drawn up in connection with the business. These accounts reflect the results of his management and indicate the trend of the business generally.

In the food industry the incidence of the cost of containers is worthy of special consideration, particularly when further economical production is being sought. Naturally, with variations in the type of food product there are big variations in the required container, ranging from paper and cardboard to glass and tinplate. The ratio of cost of container to cost of contents should invariably be studied. Taking representative figures for a typical section of the food industry where the total prime cost (materials and wages) amounted to £100,000 for a period, the analysis showed 51 per cent. (£51,000) for raw materials, 30 per cent. (£30,000) for containers, 4 per cent. (£4,000) for labels and wrappers, 9 per cent. (£9,000) for production wages, and 6 per cent. (£6,000) for cases and packing materials. If we assume that the raw materials have been obtained at the best market prices prevailing and that there is no intention on the part of the producer to reduce the quality of the product, then the figure for raw material cost should not be capable of much further direct pruning.

If, however, the figure for raw material is combined with that for containers, it will be seen that out of £81,000, representing the cost simply of containers and contents, an amount of £30,000 is despatched to the consumer as containers, which are eventually thrown away.

In every section of the food industry detailed figures should be compiled to show the cost to the producer to "house" every thousand pounds' worth of his raw material. In the instance quoted above, a saving of 10 per cent. on container costs would show an additional profit to the producer of £3,000 without in any way affecting the quality of the food product or reducing its intrinsic value to the consumer.

There has already been a tendency in the food industry to switch to new types of cheap containers of the mono-service vessel pattern, particularly in the catering sections of the trade, for serving "individual" portions of foodstuffs. Certain food producers are marketing small portions of sauce or ketchup in moisture-proof cardboard containers instead of glass. Such containers as these must result in reduced container costs in the production of these lines.

The keen manager should continually keep in contact with the sales research section, as investigations by this section into the type of container required by the trade will lead to suggestions which should be taken up for development by his technical personnel.

In certain branches of the food industry the main division of expenditure on containers is between glass and tin. Presuming that rock bottom prices are paid for glass, it should be considered whether it is possible to reduce the expenditure ratio of glass to contents by eliminating very small sizes of glass packages. Consider, for instance, the sale of such a product as capers. These are usually packed in a small 2-oz. bottle. If the sales research section confirmed that the trade would prefer to buy them in large wide-mouthed bottles (from which they could be readily removed with a teaspoon), then the producer in putting out such a package would automatically reduce his container cost in disposing of a given amount of raw material. Furthermore, consumers might be educated to the fact that in many instances it is to their advantage to buy the larger sized packs, particularly when the value of the ingredients is relatively low to the cost of the container and where the producer is not involved in heavy overhead charges. Products such as malt vinegar and fruit beverages would probably come into this category.

Every item which contributes towards the cost of containers in the manufacturing account should come under review by the producer, and consideration should be given to such problems as:

(*a*) The substitution of tin containers for glass or glass for tin for certain products.

(*b*) The development of simplified and cheaper closures for bottles and jars.

(*c*) The use of lighter tinplate.

In connection with the purchase of glass containers, the producer must avoid the error of reducing the nature or quality of the container to get down to a new reduced price, as the savings in such an instance are invariably more than wiped out by losses from breakages both before and after the container is filled. If breakage does occur during the closing of the jar after it is filled, there is an additional loss of the packed material and a wastage of productive labour.

The alert productive manager will endeavour to maintain in his productive organisation a complementary section to the sales research section, and use it for the technical development of suggestions based on the requirements of the trade. Let us suppose, for instance, that the sales section desire to sell in a tin container a product normally sold in glass. The sales research section would indicate the possibilities of such a product in the trade and the selling price at which it would become established. The complementary technical section would evolve ways and means of producing the line down to that price. This would involve investigations into such items as the purchase price of the plate, the size and weight of plate to be adopted, and the possibility of arranging the productive machinery in such a way that a standardised plate could be used throughout for all operations. This latter item is important in that the

development of a new line might possibly call for a special sized plate not of standard dimensions. Any subsequent "trimming" of standard sized plate is costly and usually wasteful.

The development of cheaper closures (usually of tin) for glass containers may necessitate the elimination of scrap during production. Economies may arise from an investigation into the methods adopted for cutting up the tinplates into the necessary strips from which the caps and bands used for closing the glass container are produced. In certain instances it may be found that by cutting the original plate lengthwise instead of crosswise the proportion of scrap would decrease in producing a bigger number of caps and bands. The alteration, however, would probably require some investigation into the possibility of rolling the plate in the opposite direction during its manufacture at the tinplate works.

The adoption of lighter tinplate generally for manufacturing purposes necessitates a study of the ratio of labour cost to tinplate cost for tin containers. There is a definite tendency nowadays towards the introduction of high-speed machinery in the manufacture of food containers. Can making plant capable of producing these units at speeds of over 300 per minute is invariably used when mass production layouts are called for. With a slow production rate the ratio of labour cost to tinplate cost is high, but with such speed the production ratio falls considerably, and it may possibly become low enough to warrant the introduction of additional sorting personnel required if a lighter and cheaper plate were purchased—the extra sorting being necessary with lighter plate where the variations in weight are between wider limits. It would be necessary to ensure that only plate suitable for the special conditions required on high-speed plant were sought out for use, and consideration would have to be given to the disposal in other directions of the balance thrown out by the sorters.

The question of container costs is daily becoming more important in the food industry generally, where it is necessary to give the consumer high-grade quality food at an economic and competitive price. In looking for savings it should be remembered that "every little helps," and, however insignificant the item, it will, with the others, become cumulative and eventually grow into an amount which will be readily visible in the manufacturing account.

FOOD AND DIETETICS

WHAT is a food? From the scientific point of view it may be defined as anything which, when absorbed into the body via the alimentary tract, is capable either of (i.) enabling it to grow or to repair its waste; (ii.) furnishing it with material from which to produce heat, muscular work, or other forms of energy; or (iii.) supplying regulators of its functions of growth, repair, and production of energy.

But, like most definitions, this one is open to criticism, although it is probably the best that can be devised. Thus tea, coffee, cocoa, and meat extracts are often popularly regarded as foods, but to the dietician tea, coffee, and meat extracts are not foods, whereas cocoa certainly is—yet they all come into the net of the above definition.

Such are the opening observations of what has become the standard work on food and dietetics, the seventh edition of which has recently been published under the joint authorship of Robert Hutchison, M.D., F.R.C.P., Physician to the London Hospital and to the Hospital for Sick Children, Great Ormond Street, London, and V. H. Mottram, M.A., Professor of Physiology at King's College of Household and Social Science, University of London.

In the thirty-three years which have elapsed since the book was first published in 1900, the study of dietetics has arranged itself alongside physiology and biochemistry as an experimental and more or less exact science. Especially to biochemistry is it indebted for data of a fundamental character, although many years have still to elapse before the passage of foodstuffs through the human body can be expressed in the language of chemistry and physics.

A glance through Hutchison and Mottram is sufficient to show that the study of food in relation to dietetics has, even to-day, advanced but little beyond the empirical stage. An enormous number of observations and experiences is available to the student. The task of assimilating information of this kind is a usually tiresome occupation and makes greater demands on the memory than can be coped with by the average scientific mind. To present such information in a fashion so interesting and intriguing that it is mentally absorbed without appreciable effort is a feat which few are capable of performing. Nevertheless, that is precisely the strong feature of this volume. The authors have succeeded in providing an attractive coating to their "pills." The book is a collection of data presented in such a way as to lead the reader from page to page. Needless to say, the data themselves are complete and up to date, so that this seventh edition goes still further to strengthen its enviable position as the standard work on the subject.

H. B. C.

("*Food and the Principles of Dietetics*," *by Robert Hutchison and V. H. Mottram. 7th Edition.* 630 *pages. Edward Arnold and Co. London.* 1933. *Price* 21*s. net.*)

Diacetyl in Butter

The following paper is an outcome of a statement made by Professor H. D. Kay (Director of the National Institute for Research in Dairying, Shinfield, Reading) at the Annual Meeting of the Society of Chemical Industry at Newcastle on July 13. He said that the flavour and aroma of butter are due largely to the presence of diacetyl, an oxidation product of acetyl methyl carbinol. During the subsequent discussion this statement was questioned by one of the speakers, who had never been able to detect in the laboratory the presence of diacetyl in butter . . . . . .

GRADING BUTTER

By W. L. Davies, M.Sc., Ph.D., F.I.C.,
of the National Institute for Research in Dairying.

THERE IS considerable evidence that the aroma and most of the flavour of butter—that is, of *full-flavoured* butter churned from ripened cream—are due to the presence of small amounts of a diketone, diacetyl, $CH_3.CO.CO.CH_3$. A reduction product of diacetyl—namely, the carbinol, $CH_3.CO.CHOH.CH_3$ (acetyl methyl carbinol or acetoin)—is a metabolic product of many types of micro-organisms growing in sugar media. Various forms of the lactic acid bacteria growing in media containing lactose—*e.g.*, milk or cream—produce the carbinol in varying amounts. The oxidation of the carbinol to the diketone occurs readily by auto-oxidation. Again, the synthetic diketone possesses an odour identical with that of butter made from cream of high acidity, and the incorporation of even as low a quantity as 0·2 parts per million of diacetyl in flavourless butter imparts a full flavour to the product. There is also evidence that diacetyl is partly responsible for the aroma and flavour of honey, roasted coffee, and tobacco smoke. The formation of diacetyl by the action of pepsin on milk has recently been established. As high a yield as 0·085 per cent. has been obtained.

Formation of Diacetyl.

It is probable that it is only the carbinol which exists in ripened cream owing to the conditions of very low oxygen concentration at which lactic acid fermentation occurs. On churning the cream into butter, the incorporation of air and the conditions of auto-oxidation which exist, due to the agency of traces of free oleic acid in the fat, bring about the oxidation of the small amounts of the carbinol dissolved in the butterfat, or in the moisture of the butter, to diacetyl. This explains why the development of the maximum flavour in butter requires storage of butter after churning for 12 to 24 hours.

Properties of Diacetyl in Butter.

The presence of diacetyl in butter, although essential for the production of the desired aroma and flavour, is a drawback in butter which has to be stored for a considerable length of time. The reason for this is that the previous treatment of the cream necessary for the production of a full-flavoured butter is such that the keeping quality of the product is shortened. In the first place, butter from ripened cream has invariably been found to be inferior in keeping qualities to that made from pasteurised sweet cream. Such storage taints as fishiness and tallowiness develop. This is due to the acidity of the cream imparting acidity to the butter, and consequently a high acid value to the butterfat. This condition hastens auto-oxidation and consequently deterioration of the fat. The oxidation of the carbinol to diacetyl also initiates an auto-oxidative process which soon involves the lecithin, and, later on, the butterfat itself. This is probably the reason why full-flavoured butter, containing appreciable amounts of diacetyl, is more prone to become fishy, and then tallowy, than flavourless butter. It is well known in the butter industry that, in order to safeguard the marketable value of butter, full-flavoured butter must be marketed and consumed within a short

time after its manufacture, but that the geographical and economic conditions forced on Australasian producers necessitate the manufacture of a comparatively flavourless butter from cream neutralised to a low acidity.

Amount of Diacetyl.

The amount of diacetyl in fresh butter from ripened cream has been found to vary between 0·05 and 0·5 parts per million. The lower limit is that of a mild-flavoured, while the higher limit is that of a strong-flavoured butter. West Country farm butter, especially when made from self-ripened cream, is usually strong-flavoured. Such cream in warm weather has developed a high acidity and is usually not pasteurised before churning; part of the flavour may be due to free oleic acid (liberated by *Oidium*), which will impart a slightly rank flavour, thus reinforcing the already relatively high diacetyl content of the butter.

Diacetyl is a greenish-yellow liquid, soluble in water and boiling at 88° C. It has a penetrating odour which is detectable by taste and smell in an aqueous solution of as low a concentration as 1 in 100 million. When incorporated into flavourless butter or margarine it is detectable in the concentration of 1 part in 50 million, while a concentration of 1 part in 2 million is much too strong a butter-flavour in the product.

There is no doubt that diacetyl is a transient substance in butter made from ripened cream. This is to be expected when it is considered only as an intermediate product in the chain of auto-oxidative reactions which proceed in such butter during storage. Determinations of diacetyl in butter, therefore, need to be interpreted in the light of such conditions as age, state of the butterfat as regards auto-oxidation, and acidity of the butter (or the acid value of the butterfat).

It is highly probable that diacetyl in butter is either (*a*) partly oxidised to a compound possessing no aroma, or (*b*) partly reduced to the non-aroma producing carbinol when the oxygen in the butter is exhausted either by bacterial action or absorption by fatty constituents. It is clear that the oxidation-reduction reaction—

$$CH_3.CO.CHOH.CH_3 \rightleftharpoons CH_3.CO.CO.CH_3$$

—requires only a little change in the oxidation-reduction potential to the positive side for the reaction to proceed from left to right. This is evident from the fact that saturation with air during butter-making can bring about the change. It is equally evident that the sweeping up of the oxygen in butter can cause the reaction to proceed from right to left, and thus lower the diacetyl content. It is well known that butterfat can take up oxygen also without showing signs of deterioration organoleptically, although the peroxide content may rise slightly. The destruction or disappearance of diacetyl has been found to occur within this period of slight oxygen absorption—the *induction period* to auto-oxidation. All traces of diacetyl, as such, have disappeared from butter which is tallowy and which shows local bleaching. High acidity of the butterfat and metallic contamination of the butter (copper, iron, etc.) cause a quicker disappearance of diacetyl than would be the case with a less acid product or where the aroma-producing constituent is incorporated artificially into a product of low acidity. Loss by evaporation into the air would also lower the diacetyl content slightly.

It is obvious that the changes to which diacetyl is susceptible will make it difficult to determine whether it has been produced naturally or added artificially to a dairy product. Some advantage may be derived from the study of parallel conditions. It has been established that the acidity of butter varies directly with the acidity of cream before churning and that the acid value of butterfat will increase according to the length of time it has been in contact with acid serum during the ripening process. The finding of a relatively high diacetyl content in association with a low acidity of butter should be viewed with suspicion as to the diacetyl being naturally present. It is true that some of the lactic acid bacteria can produce a full flavour in butter at lower acidities of the cream than other types, but the propagation of "starters" containing such types is as yet only in the experimental stage. There are also no data available concerning the distribution of diacetyl, or of its precursor, the carbinol, in cream between the butter and the buttermilk obtained on churning. It is to be expected that a distribution in favour of the fat-rich fraction, the butter, would exist, and that on adding diacetyl to cream, a certain length of time should elapse before the distribution equilibrium would be attained, though possibly the churning process would speed up the gaining of equilibrium conditions.

Detection and Determination of Diacetyl.

Two reactions of diacetyl may be taken advantage of as far as its detection in traces is concerned. The diketone can condense with hydroxylamine to form dimethylglyoxime, which forms a red nickel compound. Also traces of diacetyl in strong alkaline solution give a permanganate to deep red colour with various compounds containing a guanidine nucleus—*e.g.*, arginine, dicyandiamide, peptone solution, and creatine. Creatine is usually used for distillates, but no reagent other than the alkali need be added when testing for acetyl methyl carbinol as a metabolic product of micro-organisms growing in media containing peptone. Shaking with air in the latter test is sufficient to cause the carbinol to oxidise to diacetyl, which gives the colour reaction (deep rose). The amount of alkali to be added should be sufficient to make the testing solution 5 per cent. with respect to the alkali (caustic soda). This test—the Voges-Proskauer reaction—is sufficiently delicate to detect 1/100th mgm. of diacetyl when carried out as a spot test on a white tile. The colour is evanescent, and attempts to standardise the test so as to adopt it for the colorimetric determination of diacetyl have so far been unsuccessful; the depth of colour is not proportional to the amount present, and condensation of some of the diacetyl to *p*-xyloquinone occurs before the full colour develops, this being probably the cause of the subsequent fading as well.

The determination of diacetyl in butter is carried out by the nickel glyoxime method on a steam distillate of the butter. The amount of butter to be taken depends on the diacetyl content and whether the nickel compound is to be weighed or estimated comparatively from the intensity of the red colour on Gooch filter discs when compared with the colours, from known amounts of diacetyl, prepared in an identical manner.

If the nickel compound is to be weighed, from 0·5 to 1 kg. of butter is distilled in the presence of 500 ml. of a 0·1N H_2SO_4 and 1 per cent. acetic acid mixture. A drop of oleic acid is added to oxidise any carbinol to diacetyl. After refluxing for 20 minutes in an all-glass apparatus (rubber absorbs diacetyl), 40 ml. of distillate are collected and kept at 90° C. for 1 hour after mixing with 10 ml. of a buffered nickel reagent (1 part 20 per cent. $NH_2OH.HCl$, 1 part 10 per cent. nickel sulphate solution, 2 parts 20 per cent. sodium acetate solution). After cooling, the mixture is neutralised to a *pH* of 7·2 and the nickel compound is allowed to settle for 24 hours, after which it is filtered through a tared sintered Jena crucible (IG_3) and dried at 110° C. and weighed. The weight of the precipitate × 0·596 is the weight of diacetyl.

The above method is trustworthy and accurate, and repeated determinations of known amounts of added diacetyl have yielded results from 97 to 103 per cent. of the theoretical values. Thus diacetyl is not partly destroyed in the distillation process.

For the filter disc comparative method, from 40 to 100 gm. of butter and 100 ml. of water are directly distilled. In all cases it is advisable to keep the receiver in ice water. The nickel compound is prepared in a similar manner to the above from 100 ml. of distillate, evaporating to a small volume and further heating for 3 hours under reflux. No neutralisation is necessary. The precipitate is collected on a filter disc in a Gooch crucible, and the colour obtained is compared with those from a series of determinations with known amounts.

Modifications of the above methods consist of direct distillation with alcohol (50 gm. butter and 20 ml. 95 per cent. alcohol, collecting 20 ml.). The use of a few drops of ferric chloride solution to oxidise the carbinol to the diketone has been advocated.

In doubtful or negative cases, the testing of the distillate by the sensitive Voges-Proskauer reaction should detect traces too small in amount to give the glyoxime test.

PECTIN

A note on its uses in confectionery and fruit beverages

Confectionery.

THE FOLLOWING observations have been supplied by Mr. Powell Williams, of Kansas City, U.S.A.:

On page 282 of the August, 1933, issue of FOOD MANUFACTURE, in your answer to an enquiry regarding Turkish Delight, we ran across the statement that you will soon publish a book dealing with "Sweet Manufacture." We, of course, do not know if you have anything in your book regarding the making of pectin confections or if you are acquainted with some of the newest developments along that line, but we give below one formula for making what we term an average jellied candy of excellent quality.

Pectin is rapidly replacing starch, agar-agar, gum tragacanth, and gelatin in the United States for making high-class jellies, Turkish pastes, etc. Pectin jellies are very brilliant and clear and have a longer shelf life than ordinary jellies, as they do not tend to dry as quickly and become hard. It is not necessary to prepare pectin the night before and it does not have any offensive odour or taste, and it is always ready to go into the batch and make the type of jelly a manufacturer wishes. Very firm products can be made by cooking to higher temperatures or by using more pectin, or by a combination of both; and for weaker jellies for centres, etc., the cook can be lower or less pectin used.

The particular type of pectin in which we are especially interested is an apple pectin named "confecto-jel" that has a very slow setting action to permit depositing work. A rapid set can be obtained for slab work by adding acid. This particular pectin will make jellies of any consistency desired, as explained above, and is a complete product, making it unnecessary to incorporate additional chemicals to make it work properly.

General Formula.

Special pectin	5 lb.
Granulated sugar	50 ,,
Corn syrup	50 ,,
Water (6 gallons)	50 ,,

Please follow our procedure very carefully, as it is important to dissolve the pectin properly by mixing it with equal weights of sugar in a dry pan and sprinkling the pectin-sugar mixture into the water and boiling for a minute or two before adding the main portion of the sugar and the glucose.

1. Mix 5 lb. of the pectin with 5 lb. of the sugar.

(*Continued on page* 351.)

CREAMED ANGELICA

Here are directions, given by John Elsbury, for preparing a really delicious sweetmeat. Creamed angelica may be nibbled with liquor or used for decorating confectionery goods.

REMOVE THE angelica from brine and lay it on a draining table. Cut it into the lengths required. The angelica should possess a good flavour and a light green colour.

Place in cold water and gently raise to 200° to 206° F., but do not boil. When tender, immerse in cold water and wash until all salt is removed.

Into each angelica stem insert a piece of ash wood, and fasten down with two or three drawing pins, one at each end and the third in the middle.

Now lay the stems in a tank or tub, four rows deep, so that alternate layers are crosswise. The vessel should be provided with an outlet at the bottom.

Place in position a wooden top put together with wooden pegs (not nails) and allow it to rest, but not too tightly, on the angelica.

Then add a cold syrup of 20° Bé. and allow to stand overnight.

Make up a new syrup of 37° Bé. and place it on one side to cool, using 4 lb. of glucose to each 28 lb. of sugar and 10 drops of 30 per cent. acetic acid, so as to obviate graining.

Next day run off the cold syrup from the tank into a steam-pan and boil it to 20° Bé. Return it to the tank.

If the angelica is of good colour add 1 gallon of the cold 37° Bé. syrup to the hot syrup in the tank in order to bring down the temperature. If the angelica is yellowish, colour the syrup pale green before adding the cold syrup.

Now draw off half the syrup from the tank; pour it over the top of the angelica and allow to stand overnight.

Next day draw off the syrup into a steam-pan and boil to 22½° Bé.

Add 1 gallon of the cold 37° Bé. syrup to each 8 gallons of the hot syrup and return it to the angelica in the tank.

Draw off half the syrup from the tank, pour it over the top of the angelica and allow it to stand overnight.

Next day, draw off the syrup into a steam-pan and boil to 32° Bé.

Add 2 gallons of the cold 37° Bé. syrup to each 8 gallons of the hot syrup, and return it to the angelica in the tank and allow to stand overnight.

Next day, test the gravity of the syrup in the tank, and if not 37° Bé. in the cold, boil to 32° Bé. hot and pour boiling hot on to the angelica and also draw off half of the syrup from the tank and pour over the angelica.

Allow to stand for 36 hours, drawing off half the syrup each day and pouring it over the top.

Take out the angelica and allow it to drain. Then dry it on trays in a hot room at about 100° to 110° F. The stems should be turned each day.

As soon as they are dry, remove the wooden sticks and allow the inside of the stems to dry for a day or so. They are then ready for creaming. Any broken pieces may be sold to the baking trade.

Creaming.

Use a mixture in the proportion of 1 lb. glucose to 7 lb. sugar. Thus one may use 112 lb. sugar, 16 lb. glucose, and 6 gallons water. Place this mixture in a steam-pan and stir well until all the sugar is dissolved. Boil to 230° F.

Place the stems of angelica in a hand-pan and pour the syrup into the latter so as to cover the stems well.

Now rub the side of the pan until a white cream is formed. Remove the stems and lay them on trays to cool. If creaming takes place too quickly take the next batch up to 229° F.; if too slow, take it up to 231° only.

COFFEE

In the third edition of *Coffee from Grower to Consumer* (Pitman's Common Commodities and Industries Series), written by B. B. Keable and revised by C. J. Parham (1933) some interesting remarks are made in the course of a discussion on coffee roasting.

The testa or investing membrane of the raw bean has a layer of long cells with a peculiar pitted structure, containing crystals of caffeine and also tannic acid, while the inner substance consists of an assemblage of vesicles of an angular form, the cavities of which contain drops of an aromatic oil called caffeone, on the presence and amount of which the fragrance and active principles of the coffee depend. The amount of "coffee oil" contained in coffee varies from 8 to 13 per cent., at least one-half of which is lost by evaporation during the roasting process, so that it may prove a paying experiment to collect it, especially in establishments where large quantities of coffee are roasted, and several pounds of this valuable oil are dissipated daily, which would no doubt find a ready market at a good profit for the making of liqueurs or for medical purposes.

The book is written in quite an attractive style and deals with the different varieties of coffee plant, cultivation, preparation for the market, data relating to the chief coffee-producing countries, statistics of production and consumption, preparation for the London market, valuing, roasting, blending, medical properties of coffee, adulterants and substitutes, coffee making, etc. We might remark in passing that the book would be improved by more careful editing. H. B. C.

THE ANISE FLAVOUR

Some interesting recommendations by H. S. Redgrove, B.Sc., F.I.C.

THE FLAVOUR of anise, or "aniseed" as it is popularly called, is associated in the mind of the average Englishman with either cough mixtures or sweets only fit for children to eat. On the Continent, however, the flavour is more highly appreciated and much more widely employed. Little cakes flavoured with anise find favour as a dessert, and in a part of South-Western France pancakes having the same flavour constitute a highly appreciated speciality. Absinthe, it is true, is banished from France, but anisette is liked as an after-dinner liqueur, and *aperitifs* having the anise flavour enjoy an immense popularity.

Production.

Several sources exist for the production of the anise flavour. The best results are obtained by using "aniseed," the dried ripe fruit of *Pimpinella anisum* L. (also called *Anisum officinale* Moench.), or the essential oil distilled from the green fruits.

The plant, an annual belonging to the Natural Order *Umbelliferæ*, is a native of Greece and Egypt, and is cultivated in Southern Russia, Spain, Bulgaria, Germany, and other parts of Europe, as well as in the East Indies, Chili, etc. It could be easily grown in South-East England if the demand warranted cultivation on a commercial scale, though there is some danger of the seeds not ripening properly in bad years.

The Spanish product is to be preferred to other varieties, as having a sweeter and more agreeable flavour; but the Russian would seem to be the sort most frequently distilled to obtain the essential oil. This oil, however, is not often met with in commerce to-day, its place having been taken, to a large extent, by the essential oil of star-anise and anethole isolated from this.

In purchasing "aniseed," more especially from Italian sources, care must be taken to guard against adulteration with the poisonous fruits of hemlock.

Star-anise is the dried ripe fruit of *Illicium verum* Hk. *f.*, a small evergreen tree belonging to the Natural Order *Winteraceæ*, cultivated in South China. Although in no way resembling "aniseed" in appearance, it possesses a marked odour of anise and yields an essential oil almost identical in character and chemical composition with genuine anise oil. The closely related Japanese star-anise tree, *Illicium religiosum* Siebold, bears poisonous fruits, and some serious and fatal accidents have occurred through confusion between the two plants.

Constitution.

Both anise oil and star-anise oil owe their characteristic flavours to anethole, which in each case is the chief constituent. Methyl chavicol (estragol) is also present and is a not unimportant ingredient. The flavours of the two oils, however, are modified by the presence of small quantities of other aromatic substances, that of true anise oil being undoubtedly finer and fresher than that of star-anise oil, or "badiane" as it is called in France. Pure anethole is isolated from star-anise oil by the simple process of freezing, followed by purification by distillation, and is considered as superior to star-anise oil as a flavouring agent, but inferior to true anise oil. It is a white, crystalline substance of low melting-point (22·5° to 23° C.), slightly soluble in water and easily soluble in spirit.

Fennel.

The flavour of fennel (*Fœniculum vulgare* Hill), more especially of its dried ripe fruit and the essential oil distilled from this, is also closely akin to that of anise, though of a somewhat more herby character. It should not be overlooked by the food manufacturer looking for flavouring agents relatively little employed in this country. Miller (*The Gardener's Dictionary*, 8th ed., London, 1768) described three distinct forms of the plant, which he regarded as distinct species. Modern botanists consider these to be merely varieties of one and the same plant, but the distinctions are important from the gastronomic point of view.

Two very different fennel oils are met with in commerce. The "sweet" oil has a flavour very close to that of anise, and, like anise oil, its chief constituent is anethole, the flavour of which, however, is modified by that of other constituents, notably fenchone. The "bitter" oil, which contains little anethole and is correspondingly rich in fenchone, is practically useless as a flavouring agent and finds its chief employment in soap perfumery.

Tarragon.

The flavour of fennel (*Fœniculum vulgare* Mill), more *Compositæ*) also has an anise-like flavour. Used with good effect in Continental cookery, it is much neglected in England, although the plant can easily be grown here.

The chief constituent of the essential oil is estragol, already mentioned as present in anise and star-anise oils, a substance isomeric with anethole. The oil is gaining in importance as an ingredient in certain modern perfumes, and tarragon is by no means without interest for the manufacturer of flavouring essences, being more especially used for the spicing of vinegar.

PECTIN

(*Continued from page* 348.)

2. Place 6 gallons of water in the kettle and bring to a boil; shut off steam.

3. Add the pectin-sugar mixture to the hot water and stir.

4. Turn on steam and bring to a boil to dissolve the pectin.

5. Add 50 lb. of corn syrup while boiling.

6. Add balance of sugar (45 lb.) while boiling.

7. Cook to 229° to 230° F. (or to 19° F. above the boiling-point of water at your altitude).

8. Flavour and colour.

9. Deposit in starch or pour on slab. (For slab work, 2 to 3 oz. of citric or tartaric acid, dissolved in water, can be added just before pouring for a very quick set.)

The above is a general formula to serve merely as a starting-point. The sugar and corn syrup can be varied. If a firmer jelly is desired it can be obtained by increasing the amount of the pectin or by increasing the finishing temperature. For a weaker body lower the cooking temperature. Any desired consistency or body can be obtained in the finished jelly.

The price is reasonable and makes the candies cost a trifle more than starch jellies, but the confectioner can make a good deal more profit than he can with the starch jellies or jellies made with other gums, on account of the very fancy grade of the products made with the aid of pectin. It can be adapted to very wide uses, such as ordinary jelly gum drops, in candy bars, centres for chocolates, and for fillings in various candy products.

We thought you would be interested in knowing about pectin in the manufacture of sweets, because it is rapidly gaining so much ground in this country that the information with a definite formula will probably be interesting to the British manufacturers; it will assist them in developing new high-class pieces that should result in nice profits for them.

The pectin for confectionery products is a different type of pectin from that sold to the preserving trade, and one will not replace the other in plant work. The former is for high temperature and high soluble solid products, while the latter is for low temperature or low soluble solid products.

Pectin in the Manufacture of Orangeade and Lemonade.

Mr. Eduard Jacobsen, of Berlin, contributes the following note on the use of pectin in the manufacture of genuine orangeade and lemonade:

In speaking of genuine orangeade and lemonade, it is intended to draw a distinction between fresh fruit drinks and the substitutes which are frequently offered.

On incorporating, for example, an ordinary sugar syrup with orange flavouring or essence, the product can, at the best, be described as a fruit-flavoured syrup, for it is entirely lacking in the characteristics of an orangeade or a lemonade. The latter should be a product containing orange or lemon juice in which the fresh fruit pulp is suspended, thus bringing about a pleasing blend of sweet and sour flavours. No additional substance should be present in a genuine orangeade or lemonade, apart from a small quantity of natural apple pectin which maintains the particles of fruit in free suspension.

Many enquiries have reached the author regarding the problem of maintaining the particles of fruit in permanent suspension, and failure to achieve this object appears to have arisen from omission of the pectin. Apart from the inferior palatability of a beverage in which the particles of fruit collect at the bottom instead of remaining in suspension, the appearance of the product is certainly not rendered more attractive, especially where bottled beverages are concerned.

As the following tests will demonstrate, judicious incorporation of fruit pectin is a certain method of preventing settlement of the fruit pulp.

Five litres of pure orange juice were warmed to 30° C. in an acid-resistant vessel and subsequently mixed with 7·5 kilos of finely granulated refined sugar, followed by incorporation of a little orange oil. After the sugar had completely dissolved, half the batch was filled into three sets of bottles containing respectively 0·5, 0·75, and 1 per cent. of pure apple pectin. The other half of the batch was filled into bottles from which pectin was omitted. Lemonade was prepared in the same manner.

After several days the position was as follows: In the six non-pectinised bottles of orangeade the fruit particles had, without exception, settled to the bottom. As indicated below, the bottles containing pectin yielded quite different results:

Orange Juice.

With 0·5 per cent. pectin: about half the fruit had settled to the bottom.

With 0·75 per cent. pectin: apart from a few particles, the fruit remained in perfect suspension in the juice.

With 1 per cent. pectin: complete maintenance of fruit in suspension.

Lemon Juice.

With 0·5 per cent. pectin: 75 per cent. of the solids remained in suspension.

With 0·75 per cent. pectin: solids maintained in perfect suspension.

With 1 per cent. pectin: solids maintained in perfect suspension.

To summarise: It will rarely be possible to prevent the settling out of solids in orangeade, lemonade, and similar beverages in the absence of pectin. The addition of pectin should be effected after the sugar has dissolved and the syrup has cooled down. After standing for 2 hours, or, in the case of sweet juices, for 3 or 4 hours or even longer, the syrup undergoes appreciable thickening, at which point the product is once more thoroughly stirred so as to distribute the fruit tissue uniformly throughout the syrup. No deposition will then take place. Another advantage of the addition of pectin is the prevention of crystallisation of the sugar, which would reduce the body and flavour to a very considerable extent.

NATIONAL MARK CANNED GOODS

A discussion of the existing regulations

by T. McLachlan, A.C.G.F.C., F.I.C.

OWING TO the Legislature being overworked with the duties of law making and to the complicated nature of modern problems, there is a tendency for Acts of Parliament to be mere frameworks on which the actual structure is superimposed by Ministers through their departments. In other words, the tendency of modern legislation is to bureaucracy, and it remains to be seen whether this method will stand the test of time or not. None the less, one cannot but feel that this allows a degree of self-government which will work for the benefit not only of the community it is wished to serve, but also for the general welfare of interested parties, whether they be manufacturers, retailers, or any other group of people, and we would most advisedly include the Marking and Grading Orders under this heading. The most interesting feature of committees set up to work these modern regulations is that they are presided over by a Government nominee, but otherwise composed in the main of representatives of the trade or profession concerned. Each committee is to be held responsible for the satisfactory working of the particular regulation with which it is concerned, in very much the same way that a school has a headmaster, but discipline in the main is vested in the prefects.

Many remarks have been made by overseas canners to the effect that they have no cause to fear the British canning industry owing to the inferior quality of the goods turned out, and it is interesting to realise that it should require Orders from a Government armchair to point out the way to success to our own canners. Besides the Grading and Marking Orders issued by the Stationery Office, the Ministry of Agriculture and Fisheries issues Marketing Leaflets No. 20 dealing with Canned Fruit and Vegetables, and No. 29 with Bottled Fruit and Vegetables. Marketing Leaflet No. 20 provides a list of recognised canners and the various fruits and vegetables they are entitled to market under the National Mark.

Apart from the information of which the small canner may be ignorant, the sizes of cans which may be employed are described, and Appendix VII. gives the actual dimensions and capacity of these cans and also the quantity of fruit which they should contain. The cans should be filled, but not overfilled, and a vacuum of not less than 6 inches is suggested. Cans employed for red and blue fruits and for peas, beans, and beetroots must possess an effective coating of lacquer, while the question of the necessity of using lacquered cans for fruits and vegetables containing water-insoluble colours is being further investigated by the Ministry. Each canner has to comply with the requirements of the Ministry as to the code marks on each tin, so that the cannery and year of canning may be traced, a stipulation with which no one will quarrel. The use of a label combining the National Mark with private brands is recommended, though labels supplied by or on behalf of the Ministry may be used, and the Mark may only be employed at the cannery for which a certificate is issued. Authorised canners are required to keep complete records, to the satisfaction of the Ministry, of every consignment of fruit or vegetables received.

While it is stated that research is being continued in the matter of colours and colour strengths, it is suggested that cherries should receive 2 to 3 gm. of Erythrosine per gallon of syrup and that strawberries and Victoria plums should be coloured with Ponceau 2 R; for the former 2 gm. are added to 1 gallon of syrup, for the latter 1 gm. per 5 gallons of syrup. At the same time, canners are free to use any dye not prohibited by law.

If there is one word on which emphasis is laid in these orders, it is the word "uniformity," and if anyone reads the orders through carefully and has not got this word fixed in his mind, he is past praying for. The chief gibe at English canning is that fruit and vegetables lack uniformity, and so in these orders it is expressly stipulated that uniformity is to be the order of the day. Apart from giving minimum and, occasionally, maximum, sizes for canning, the size of the fruit or vegetable should be reasonably uniform, the variety of a particular fruit should be uniform, and the colour and tenderness should be uniform.

Other useful hints are given as to the freshness at the time of canning, freedom from blemishes, stalks, leaves, skin, roots, stems, soft spots, cores (as the case may be), and, as if the above warnings were insufficient, other extraneous matter.

Appendix III. describes the varieties of fruit which may be packed under the National Mark and their average size; the approximate numbers of each size required for the particular cans are described in Appendix IV. It is probable that even better grading into size than that suggested would prove useful in the cannery, but there is the difficulty that if too fine a grading is attempted the fruit or vegetables may be damaged in the process.

Finally, directions are given as to cleanliness and equipment of canneries, the cleanliness of the workers, the supervision of processing, and examination of the finished product.

The suggested standards as regards sizes of fruit and vegetables, syrup grades, and can contents will not be

made compulsory till the 1934 season, and may be amended if found desirable as a result of this season's workings, so it is to be hoped that manufacturers will have prepared their data carefully not only for their own benefit, but for that of the industry as a whole. It will be realised that much can be achieved by the pooling of knowledge, since the housewife will get to know and recognise the graded marks even better than the actual canner's label, and if she finds that certain graded brands do not come up to the standard of imported ones, she will be tempted to condemn the Mark as a whole. In our experience, many factories have decided to employ chemists for the first time and taken men from the university with no knowledge of the particular trade, with the result that they have frequently found them wanting and condemned chemists as a class as no good. The same applies to graded goods: they must be up to the standard and worthy of their grade; no canner can afford to lag behind his competitors; he will not only be found wanting himself, but his friends and his whole industry will stand condemned in the eyes of the purchaser.

Marketing Leaflet No. 29, dealing with Bottled Fruits and Vegetables, is very similar to No. 20, except that the varieties of fruits and peas approved vary slightly from those permitted to be canned. It is stated that the question of size grades for plums and gooseberries and of suitable syrup strengths are under consideration with the Food Manufacturers' Federation. No vegetable (except rhubarb) may be cooked below 240° F., and vacuum control has to be employed in all factories; moreover, fruit has to be sterilised in tanks or vessels with reasonably controlled uniform temperature.

There are just two points which surprise one in connection with these excellent leaflets: the first is why the Ministry so generously distributes the Marketing Leaflets, containing much auxiliary information, together with an almost verbatim copy of the actual Orders, for each of which one has to pay 2d.; the second point is that the Orders, and therefore the leaflets, allow the use of any preservative permitted by the Preservative Regulations, 1927. For some unknown reason the Preservative Regulations, First Schedule, Part I., 7a, allow any fruit and fruit pulp not otherwise specified in the schedule to contain 350 parts of sulphur dioxide per million, or ·035 per cent., and therefore, presumably, all graded canned or bottled fruit may contain this amount of preservative. Why the Regulations allow the use of sulphur dioxide in fruit and not in vegetables is beyond anyone's comprehension. It is known that fruits may be sterilised far more readily than vegetables or meat; therefore, if vegetables or meat must not contain sulphur dioxide, one is at a loss to understand why it is permissible in the case of fruits, though it will be appreciated that the Minister of Agriculture was content to assume that all would be well provided that the Preservative Regulations were satisfied so far as their requirements were concerned.

CORRESPONDENCE

BRITISH CANNING

To the Editor.

Sir,

In being asked to give an expression of opinion upon this question, dealt with in your July issue, I at first felt that it was an undue compliment, but then came the thought that inasmuch as fruit canning in the Dominions is materially interwoven with fruit canning in Britain there is reason in your request, and I can say a word without being charged with effrontery.

Just as it is hoped that the canned fruits of South Africa will find increasing favour in the British and Empire markets, so should Britain look for a considerable market for her special fruits in her sister states overseas. There is thus a mutual interest that foodstuff canning both in your country and in mine should develop along sound and proper lines, and any influence directed towards this is to be welcomed.

Mr. Vassie's extremely able survey is a very timely effort and will be a particularly useful one if it puts a check upon the spate of "new issues" that have characterised recent years—ever since, indeed, the "boosting" of fruit and vegetable canning became the main pursuit in the lives of some who should have tinctured their enthusiasm with reason.

There are folk established in business with so little faith in their own powers as to shake every time they hear of some "new Hotspur in the field," but these fears are little warranted if the conduct of their own business is right and the work of the rivals is of a quality to bring credit to an industry. There is room for all good canners. A real fear is warranted, however, in the creation of a number of mushroom concerns with neither sufficient capital nor experience to justify themselves, and it seems to me that these inadequacies are apparent in a considerable number of recently floated canneries. It all looks so easy to the novice; the farmers of a district speak of having surplus fruit; statistics show that so many thousands of hundredweights of canned goods are sold each year; the value of importations is impressive; Mr. So-and-so spoke most glowingly at a meeting held the other night; the task of cooking must be comparatively simple; machines can be obtained to close cans; a man who was once in a cannery lives round the corner, so hoop-la! "Let's establish a cannery."

Mr. Vassie lays a finger broadly on a number of important issues, indicating that it requires capital and capacity to steer clear of rocks that wreck. Sober think-

ing and studied action are much required in the industry to-day, and I hope that the Empire Canning Council will seize an opportunity which I feel it has long neglected —of establishing itself as a force co-ordinating the efforts of canners' councils or associations in Britain and in countries throughout the Empire.

Yours faithfully,
S. CRAIG BAIN.

VITAMINS AGAIN

DEPARTMENT OF PHYSIOLOGY AND BIOCHEMISTRY,
UNIVERSITY OF LONDON,
September 8, 1933.

To the Editor.

SIR,

I had intended to ignore the remarks of Mr. R. Whymper which you reproduced on page 267 of the August number of FOOD MANUFACTURE, as I did not consider that they added anything of value to the discussion of the subject. As you have invited me to reply, I will say that few would deny that the commercial exploitation of vitamins has often been abused. I am, of course, entirely in agreement with Mr. Whymper when he deplores this unfortunate development. I think, however, that he describes a state of affairs very much worse than that which exists at the present time in Great Britain. It would certainly be impossible to accept his sweeping statements as a general condemnation of the methods employed by a large section of the food industry in this country. I have followed closely the development of the production of vitamin preparations and foods, and I can assure Mr. Whymper that nowadays one rarely encounters a flagrant case of the public being deliberately misled.

He must surely be aware that the products intended for medicinal use are almost without exception prepared with great care and subjected to rigorous assay to control their physiological potency. When we consider the treatment of foods it must be recognised that most of the technical processes which might be covered by his use of the word "tampering"—for example, removal of the germ from wheat, pasteurisation of milk, canning of fruit and vegetables—are unfortunately the inevitable consequences of the increasing complexity of our civilisation, which renders it more and more difficult for the population to obtain fresh foodstuffs.

It would be ungenerous to ignore the fact that many of the commercial firms concerned have expended large sums of money on scientific research in order to improve the food value of their products. Many examples might be given, but I will only mention the extensive series of investigations carried out by the fruit canning industry, which have been to a large extent successful in solving the difficult problem of protecting the vitamins during processing. I mention this case because Mr. Whymper's choice of examples is not altogether fortunate. Tomato juice is one of the most valuable sources of some of the vitamins for young children, and there is to-day an extensive use of the preserved juice for this purpose. I must also point out that Dr. A. F. Hess, of New York, has recently demonstrated that milk which has been suitably irradiated, or which is derived from cows fed on a diet composed in part of irradiated yeast, is considerably more effective in the treatment of infantile rickets than cod liver oil.

If Mr. Whymper wishes to continue his attack I suggest that he directs it against the advertising and publicity agents, who so often are responsible for the misleading or exaggerated statements, but I hope he will prosecute it with greater accuracy and in better taste than was shown in the remarks which he made about my profession.

I am, Sir, yours, etc.,
J. C. DRUMMOND.

Maize Farming.
(*By courtesy of the High Commissioner for Canada.*)

TRADE NOTES

Cleaning Ham Boilers.

We quote the following from a pamphlet issued by the Ham Boiler Corporation of Port Chester, U.S.A.:

The Adelmann Washer reduces to the minimum the time and labour necessary to keep your ham boilers or other meat retainers in a clean, sanitary condition.

Brine, burnt fat, or other residue, injurious to product and retainer alike, cannot remain. The brushes revolving in water combine a forced spray with a good scrubbing. Brush spindles are refillable.

Once a boiler that has been neglected is thoroughly cleaned with this machine, a few seconds daily will suffice to keep it clean. The life of your boiler will be greatly lengthened.

No skill or effort is required of the operator. Simply hold the retainer to be cleaned in contact with the brushes, moving a bit so that all sides and corners are engaged.

The triangle formation of the brushes is designed with a purpose. Oval boilers or large square boilers will straddle all three brushes. Narrow square boilers will straddle any two brushes, and small meat loaf pans or luxury loaf containers will straddle any one.

A list of the chief users of the Adelmann Washer is published in the pamphlet referred to, and is certainly a very imposing one. All enquiries in this country should be addressed to R. W. Bollans and Company.

Lecithin.

We have received the following communication from Messrs. Fredk. Boehm, Limited:

'It has come to our notice that lecithin has lately been offered in the home market by firms not licensed under the existing patent. We feel, therefore, that it is as well to point out that the use of lecithin in the confectionery trade is covered by the following patent: No. 330,450 of July 8, 1929.

'According to the English Patent Law, unlicensed sellers of lecithin are free to offer and sell such lecithin, but *actual consumers* of unlicensed lecithin lay themselves open to action for infringement. It should be made clear, therefore, that only lecithin made by the following firms is licensed to be used by the chocolate trade:

Hansa-Muehle G.m.b.H., Hamburg,
"Emulgo"—Hansa-Lecithin

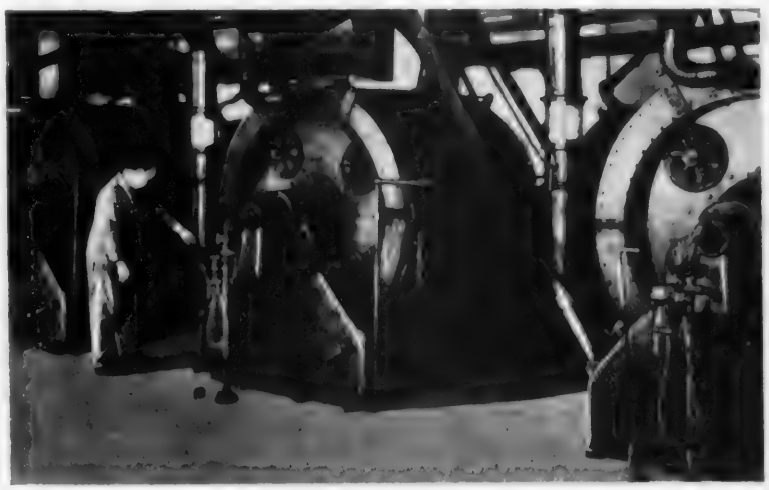
Sole distributors:
Fredk. Boehm, Ltd.

Aarhus Oliefabrik A/S, Denmark,
"Collabrac."

Sole distributors:
A Boake Roberts and Co., Ltd.

Danske Soyakagefabrik A/S, Copenhagen,
"Chococithin."

Sole distributors:
Henry A. Lane and Co., Ltd.'



Cocoa Roasting by Gas.
(*By courtesy of the British Commercial Gas Association.*)

Foodstuffs at Prague Fair.

The autumn fair at Prague is reported to have met with a good deal of success. The foodstuffs section contained a large number of exhibits, and a good deal of produce was sold on the spot. Among the most popular commodities (according to a local correspondent) were vegetable preserves, meat preserves, compressed beef tea, chocolates, confectionery of the more expensive type, and medium-priced fish preserves.

* * *

Evaporating Milk.

A pamphlet illustrating the Bertrams twin cylinder drying machine has been received from Bertrams, Limited, of Edinburgh.

This machine is specially designed for evaporating liquid substances containing solids in suspension, and consists of two steam-heated drying cylinders revolving in unison. The liquid is fed to the upper valley formed by the peripheries of the cylinders, the ends being closed by plates or dams. A film of the liquid is deposited on and adheres to each of the cylinders, and is dried before the cylinders make a complete revolution, when it meets steel doctors or scrapers and is thereby scraped off, falling into suitable bins or conveyors.

The dryer is used in connection with the evaporation of milk, yeast and chocolate drying, and similar processes.

A straightforward and interesting account of the machine is contained in the pamphlet referred to, copies of which may be had on application to Bertrams, Limited.

* * *

Cutting and Crumbing Machines.

An interesting list of hand and power machines for cutting, slicing, grating, and shredding all kinds of foodstuffs, including cheese, nuts, fruit, and vegetables, has been received from D. Fulton of Glasgow.

Model A is stated to be a high speed machine, capable of taking whole turnips, cabbages, and beetroots, cutting, shredding, or slicing them easily and quickly by feeding through a small feed tube on one side of the machine. It is merely necessary to change the cutters in order to alter the operation from potato chipping to bread crumbing.

There are two other machines described in the list, together with further interesting information on the approximate output for samples of various foodstuffs.

Tecalemit at the Fruit Show.

We have received some interesting particulars from Tecalemit, Limited, in connection with their display at the forthcoming Imperial Fruit Show at Bristol.

Their exhibits are to include the well-known range of "Tecalemit," "Zerk," and "Dot" nipple systems, and hand guns of all sizes. In the canning industry, the "Dot" system is already well known and proved, together with the practice of nipple grouping, various adaptations of which will be shown.

Probably the most interesting development this year will be the mechanical lubricators for use with oil and grease —namely, the "Brentford" and "Midget Radial" pumps. These are available in practically any variation or combination of sizes.

* * *

Morris-Commercial Orders.

The London and North-Eastern Railway Company have placed a further repeat order for forty 1-ton and 30-cwt. Morris-Commercial lorries. They already have nearly 200 vehicles of this make in service in various parts of the country.

Other orders for the new Morris-Commercial vehicle have just been placed by Lord Sackville of Knowles through Messrs. Humphrey and Co., Sevenoaks; the Earl of Dudley through Messrs. Stour Valley Motor Co., Stourbridge; and the Countess of Inchcape through Mr. James McHarrie of Stranraer.

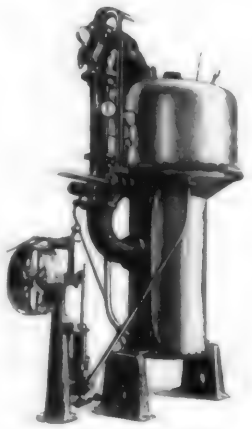
* * *

At the Canners' Exhibition.

During the Canning Exhibition at Bristol held from October 27 to November 4, FOOD MANUFACTURE and *Food Industries Weekly* will be represented in the Coliseum at Stand No. 36.

This stand will constitute a temporary meeting-place for us and our friends, and we cordially invite all readers who may happen to be in Bristol at the time to call along there and see us.

Evaporation.



The above illustration (reproduced by courtesy of F. Jahn and Company) depicts a modern evaporating plant for continuous throughput.

* * *

Dyestuff for Canners.

An announcement of interest to canners is that Imperial Chemical Industries have evolved in Edicol Pea Green D a dye for canned peas which, it is claimed, overcomes the various obstacles which have previously confronted the canner of this vegetable. There is little doubt that the consumption of processed peas in this country has been considerably retarded up to the present by the unappetising appearance of the majority of the brands at present marketed. This is, of course, due to no fault on the part of the canner himself, for natural colouring matters are inevitably marred or destroyed altogether through heat or other causes during the canning process.

Edicol Pea Green D has, it is claimed, been found after exhaustive tests to give a natural green coloration to the peas, which are quite free from selective staining, and a liquor which is practically water-white.

America Defines Foods.

The following new and official definitions have been adopted by the U.S. Secretary of Agriculture:

APPLE BUTTER is defined as the semi-solid product obtained by cooking to a suitable consistency the strained edible portion of apples with sugar and/or dextrose, with or without one or more of the following: apple juice, boiled cider, spice, salt. In its preparation not less than five parts by weight of the strained apples are used to each two parts by weight of sugar and/or dextrose. The product has a characteristic apple flavour and is commonly spiced.

EVAPORATED APPLES are peeled, cored, and sliced apples from which the greater portion of the moisture has been evaporated. The finished product contains not more than 24 per cent. of moisture.

DRIED APRICOTS are halved and pitted ripe apricots from which the greater portion of the moisture has been evaporated. Before packing, the dried fruit is commonly processed by washing. The finished product contains not more than 26 per cent. of moisture.

DRIED PEACHES are halved and pitted ripe peaches from which the greater portion of the moisture has been evaporated. The finished product contains not more than 26 per cent. of moisture.

DRIED PRUNES are whole, ripe prune plums from which the greater portion of the moisture has been evaporated. The finished product contains, in the fleshy portion, not more than 25 per cent. of moisture.

MACARONI is the shaped and dried doughs prepared by adding water to one or more of the following: semolina, farina, wheat flour. It may contain added salt. In the finished product the moisture does not exceed 13 per cent.

* * *

Mr. T. Crosbie-Walsh.

We understand that Mr. T. Crosbie-Walsh has severed his connection with the Warren Produce Company and is now establishing himself in consulting practice in London in connection with the canning industry, with special reference to the packing of poultry and meat products.

SWEET POTATO STARCH

A Note on the Commercial Production

ACCORDING to F. H. Thurber, of the U.S. Bureau of Chemistry and Soils, in an address recently delivered before the American Chemical Society in Chicago, the following procedure is adopted: Sweet potatoes are ground in a hammer mill, the resulting pulp is treated with alkaline sulphite solution to remove colour-producing compounds, and is then screened. The starch is collected in an imperforate basket centrifugal, after which it is taken up in dilute alkaline sulphite solution and tabled twice in the usual manner.

Starch from the tables is suspended in water and is then collected and washed in a perforate basket centrifugal or on a vacuum filter. The washed starch is again suspended in water and neutralised with acid (*p*H 5·0), after which it is collected, washed, and dried.

INFORMATION and ADVICE

SOUP POWDERS—GLAZING CHOCOLATE PEANUTS—JELLY SYRUP—FRUIT PULP—LIQUID COFFEE—ICE-CREAM POWDERS—MUSTARD FLOUR—COD LIVER OIL EMULSIONS—GLACÉ CHERRIES—PICKLE TROUBLES—CREAM STABILISATION

Soup Powders.

1,457. *We shall be glad of any information as to the preparation of soup powders.* (New Zealand.)

In reply to your enquiry, it is difficult to give any precise information as regards the manufacture of soup powders, as the composition, especially the flavouring, of these, depends on individual tastes.

The bases of dried soups such as you mention are mixtures of various flours; for instance, pea soup might consist of, say, 80 lb. of pea flour, with 40 lb. corn-flour, and 40 lb. potato flour. Then in the case of lentil soup, you would use lentil flour instead of pea flour, and perhaps sago flour instead of corn-flour, and in tomato soup you might use only potato and sago flours.

These flours are flavoured with onion powder and salt; with lentil and tomato soups you would have a little sugar added, and pea soup would probably contain a small amount of powdered gelatine.

White pepper would be used for pea soup and lentil soup, and in the case of tomato soup you might add ground cassia and curry powder.

In both pea and lentil soup you would add beef extract, and in the case of tomato soup, you would, of course, incorporate tomato purée.

In manufacture, the usual plan is to place all the ingredients, except the beef extract, in a steam pan, and after making hot and stirring all the time, the beef extract dissolved in boiling water is allowed to drop into the pan and the heating and stirring continued until the product is dry, and then it is pressed into cubes.

In the case of tomato soup, you could use dried tomato instead of the purée.

Glazing Chocolate Peanuts.

1,458. *Further to our telephone conversation regarding glazing on chocolate, we should be greatly obliged if you could give any information as to how we could make a glaze on roasted pea-nuts covered with chocolate.*

A number of experiments have been carried out with gelatine and gum arabic, but these have proved a failure after a period of 15 to 24 hours' duration, but we do not think it is due to moisture from the nuts. (London.)

We would suggest that you try the following:

30 per cent. gum benzoin.
70 per cent. alcohol.

Powder the gum and add the alcohol. The mixture should be kept in a tightly closed vessel in a warm place. Agitate frequently until the gum is dissolved, and then filter.

Jelly Syrup.

1,459. *Will you please recommend a formula for preparing jelly syrup to be put up in glass bottles and able to withstand this climate?* (Singapore.)

All that is required, we suggest, is to use 1 lb. less of gelatin in each batch of 30 gallons of the mixture used for ordinary jelly manufacture. We have already given recipes and particulars regarding manufacture for ordinary jelly making. What you really do is to make a slack jelly which in hot climates will not set until the temperature is reduced by icing.

Cruess and Marsh recommend putting up in bottles pure fruit jelly juices which when mixed with sugar set to a jelly. As an example, in the preparation of plum jelly juices, water was added at the rate of 8 gal. per 100 lb. of fruit; the mass was cooked until soft, and pressed in a rack and frame press to expel the juice. They obtained a yield of 14 gal. of a reddish coloured cloudy juice testing 8° Balling. This juice was concentrated to 10° Balling by boiling in the open and then filtered brilliantly clear through a filter. A portion of this juice was bottled in 6½ oz. glass bottles, another was canned in 8 oz. plain tin cans, and another in 8 oz. lacquered cans. The cans and bottles were pasteurised for 30 min. at 175° F., cooled and stored at 80° to 85° F.

Mixed with an equal volume of sugar, this juice produced a light, red, clear, rather stiff jelly when concentrated to a boiling point of 221° F. With 1½ volumes of sugar the jelly was too soft when boiled to 221° F. and cooled. When used with sugar in the ratio of "cup for cup" an excellent jelly was obtained.

Fruit Pulp.

1,460. *I have gone carefully through Mr. Potter's article in the July issue and am somewhat at a loss as to how to arrive at the correct amount of SO_2 to add to the fruit. It would appear to me that the best way of adding the preservative would be in the form of 6 per cent. sulphurous acid. Apparently the amount of SO_2 allowed, assuming the contents of a cask weighed 666 lb., would be 1 lb. Would it be correct to add 1 lb. by weight of the 6 per cent. acid to this weight of fruit?*

There are certain difficulties in dealing with the fruit as described in your last paragraph, and it occurs to me that if the fruit is poured into the casks hot, and SO_2 added, and sealed immediately, there should be no danger of fermentation. (Midlands.)

As you say, probably the best way of adding the SO_2 is in the form of 6 per cent. SO_2, but you appear to have the impression that the regulations permit 2,000 parts per million of this 6 *per cent. acid.* This is, of course, incorrect—the amount allowed is 2,000 p.p.m. of SO_2 gas. If, therefore, 6 per cent. solution is used the amount required per 666 lb. of fruit would be 1¼ gal. of 6 per cent. sulphurous acid. The usual size of cask used by manufacturers is a nominal 40 gal., which will hold about 400 lb. of pulp and would require about 1 gal. of 6 per cent. sulphurous acid to preserve it.

With regard to the second paragraph of your letter, *re* the addition of SO_2 to the hot pulp after filling into the cask, this is undesirable, owing to the fact that the preservative would not mix intimately with the pulp, and this is the secret of success. If the cask were shaken or rolled after the addition of the SO_2, in this way the amount of gas suddenly generated by the heat of the pulp would cause loss and probably blow the bung. The preservative is far better added and mixed well with the pulp before heading up the cask.

Liquid Coffee.

1,461. *Will you please supply a recipe for liquid coffee?* (India.)

We would refer you to an article on this subject published in July, 1932. As an example of a recipe the following may be given:

Coffee (a mixture of suitable grades) ...	4	lb.
Water	10	gal.
Glycerin	3	lb.
White sugar	18	lb.
Glucose	18	lb.
Caramel	2½	lb.

Ice-Cream Powders.

1,462. *We shall be obliged if you will kindly send us at your early convenience suggested formulæ for ice-cream powders.* (London.)

We have no information on this subject beyond what was published in the November, 1931, and May, 1932, issues. We are, however, having the subject investigated with a view to publication of further information.

Mustard Flour.

1,463. *Wanted a good formula for mustard flour, sold as Colman's mustard, with details of machinery required for a small plant.* (India.)

It is, of course, beyond our means and desire to give a formula for Colman's mustard. You might submit a sample to a chemist for him to match to the best of his ability. It is largely a question of choice of the varieties of seed and their proportions, and the incorporation of farinaceous matter, if any.

Cod Liver Oil Emulsions.

1,464. *Could you give me a few recipes for the preparation of cod liver oil emulsions?* (America.)

Probably the greatest sales of all cod liver oil emulsions are those with malt extract, and since the 15 per cent. v/v emulsions are the most popular, the B.P. has decided to adopt this as a standard. Of course there are other popular emulsions, such as Bynol, which contain 30 per cent. v/v, and some contain 10 or 20 per cent., but 15 per cent. is the standard. To conform to the B.P., 900 parts by weight of malt extract and 100 parts by weight of cod liver oil are emulsified together. The B.P. ignores flavourings, but these should come into the percentage of malt extract, though they are not added till towards the end of the preparation of the emulsion. The emulsion is best made by warming the malt extract to about 40° C. and stirring in the cod liver oil. Popular flavours are bitter almond oil (*sine* prussic acid), peppermint oil and vanillin, usually in admixture to a total of about 0·15 per cent. Chloroform is also usually added, and this is in rather larger quantity.

If you keep more or less to the B.P.C. formulæ and to one of the Scott's emulsion type you should not go too far wrong.

B.P.C.

Cod liver oil ...	50·00
Gum acacia, powdered	12·50
Syrup	6·25
Bitter almond oil (*sine* HCN) ...	0·10
Aqua dest. ad ...	100·00

B.P.C. Compound.

Cod liver oil ...	50·00
Yolk of egg by vol.	7·50
Tragacanth in powder	0·25
Elixir of gluside ...	1·04
Tinct. benzoin ...	1·04
Spirit of chloroform	3·12
Bitter almond oil (*sine* HCN) ...	0·10
Aqua dest. ad ...	100·00

B.P.C. With Glycerophosphates.

Cod liver oil ...	50·00
Calcium glycerophos.	0·91
Iron glycerophos. in scales	0·45
Mag. glycerophos. ...	0·45
Pot. ,, ...	0·45
Sodium ,, ...	0·45
Glycerophosphoric acid	1·04
Tragacanth 20 per cent. powder ...	0·25
Elixir of gluside ...	1·04
Tinct. benzoin ...	1·04
Spirits of chloroform	3·14
Bitter almond oil (*sine* HCN) ...	0·10
Aqua dest. ad ...	100·00

B.P.C. With Hypophosphites.

Cod liver oil ...	50·00
Sodium hypophosphites	1·83
Calcium hypophosphites	1·83
Yolk of egg by vol.	7·50
Tragacanth in powder	0·25
Elixir of gluside ...	1·04
Tinct. benzoin ...	1·04
Spirits of chloroform	3·12
Bitter almond oil (*sine* HCN) ...	0·10
Aqua dest. ad ...	100·00

The method of manufacture is roughly to triturate the oil with the gum, using all the oil at once when gum acacia is used, and only a portion when tragacanth is employed; add the previously beaten yolk of egg, stir briskly and stir in the water, adding briskly, alternately with the remainder of the oil. Hypophosphites or glycerophosphates should be dissolved in the water before emulsifying. Flavourings are added just before making to volume. If a homogeniser is employed there is not so much necessity to worry about the preliminary technique, but it should be remembered that many people are unsuccessful with a homogeniser because they try to use it at too close a clearance. It is better to run an emulsion through a homogeniser twice at a coarse clearance than once at very slight clearance.

Scott's Emulsion Type.

Cod liver oil ...	150·0 grams
Glycerine ...	50·0 ,,
Calcium hypophosphite ...	4·3 ,,
Sodium hypophosphite ...	2·0 ,,
Trag. in powder	3·0 ,,
Gum acacia ...	2·0 ,,
Water ...	149·0 ,,

Flavouring, 2 drops each of oil of wintergreen, tinct. of cinnamon, and bitter almond.

National Formulary.

Cod liver oil ...	464 grams
Gum acacia ...	112 ,,
Syrup of tolu ...	100 ,,
Flavouring as desired	
Water to ...	1 litre

The N.F. recommends 4 c.c. of oil of wintergreen, but bitter almond oil and peppermint are more popular in this country.

Elixir of gluside is 5·0 per cent. saccharine (acid), 3·0 per cent. of sodium bicarbonate, 12·50 per cent. of S.V.R., and water to 100.

We should perhaps mention that the B.P. requires its malt extract to contain not less than 4·5 per cent. of protein w/w, but the higher the proportion of protein the easier it is to form an emulsion.

Another report on the preparation of cod liver oil emulsions runs as follows:

"With regard to the question of cod liver oil emulsions, which was discussed between the writer and yourself yesterday, we find that from our experience the average oil content of the emulsion is 33·3 to 50 per cent.

"Several of the proprietary brands contain 40 per cent. of cod liver oil, whereas a number of manufacturing chemists produce two or three qualities—*i.e.*, 33·3 per cent. cod liver oil, in accordance with B.P.; 50 per cent. cod liver oil, in accordance with B.P. Codex; 50 per cent. cod liver oil, made up to a proprietary formula.

"In our own laboratory we have worked out the following formula, which gives very good results: 75 gr. gum arabic powder is dissolved in 900 c.c. water. This solution is placed in a tank fitted with mechanical stirrer, and 600 c.c. cod liver oil are added. Stirring is continued for about a quarter of an hour, when a good primary emulsion is made. Further ingredients, such as oil of bitter almonds, hypophosphites, glycerophosphates, etc., are added, and the primary emulsion is fed to a De Laval homogeniser. Homogenisation is carried out at a pressure of 3,500 lb. per sq. in., when an absolutely stable and even emulsion is obtained of a suitable viscosity for pouring from a bottle."

Glacé Cherries.

1,465. *We much appreciate your letter of June 29, and look forward to hearing from the two firms mentioned therein.*

We have been working on the cherry process in your issue of September, but regret to say that we have found it not at all satisfactory, in that by the time the process is finished exactly in accordance with this formula, the cherries have lost very considerable weight from the original weights when taken from the barrels.

We are very interested to know whether you have received any other comment in connection with this formula, and whether there has been any mistake in the quantities given.

Cherries processed in England, landing in New Zealand,

seem to be quite full and fleshy, whereas the various quantities we have put through under the formula published have turned out shrivelled, and not by any means the round even fruit that we have in the past imported from England.

If you are in possession of any alternative formula we would very much appreciate having this. (Australia.)

Possibly your trouble is due to the difference in climate between this country and Australia.

We would suggest that you try using for your first solution a syrup of 2° Bé. less than the 20° Bé. advised in the article, and then follow up with 2° Bé. less for the subsequent syrups.

If you find at any stage the cherries begin to shrivel, make the next solution 3° less. Another point is to see that the cherries are well cooked before starting on the syruping process, otherwise they will not take the syrup. 100 lb. of cherries after leaving the cooking tank weigh about 110 lb. when drained.

For the syruping of bleached and brined Maraschino cherries, after pitting and soaking to remove SO_2, Campbell states that they are well drained and covered with a syrup of 17° to 19° Bé. in which they are allowed to remain overnight. The syrup is drained off and concentrated 2° or 3° each day until the density reaches 29° to 30° Bé. (hot). The colouring may be added to the first syrup. It may, however, be added to the soaking water in which the fruit is allowed to remain for ten days. In this case, they are covered with a 14° to 18° Bé. syrup for another ten days. Drain and cover with a 22° to 25° Bé. syrup for ten days more. Should a sweeter product be desired, increase the syrup to 30° Bé.

G. K. Kidd states that if the candying and colouring of the cherries is performed in one operation, Ponceau is used with the first sugar syrup, starting with a 30° Balling (16·6° Bé.) cold syrup to which Ponceau has been added at the rate of ½ oz. to 40 lb. of cherries. Colour is increased for the shade desired in future boilings, three boilings being used to bring the product up firmly and evenly filled. In the first boiling add sufficient citric acid to make the solution quite acid.

If erythrosin is used for colouring instead of Ponceau, the ratio is usually 16 oz. of the dye to 4 lb. 8 oz. of sodium bicarbonate in 40 gal. of water, being sufficient to start dyeing the amount of 280 lb. of cherries. After pitting, the cherries are heated in this solution at 200° F. for 2 hours, and the mixture is allowed to cool overnight. Following this they should be washed and treated in a bath containing 8 oz. of acetic acid (28 per cent.) in 40 gal. of water, keeping the solution at a temperature of 200° F. for 2 hours, and allowing it to cool overnight. After this final treatment the fruit is washed and subjected to various syrup solutions, which are acidified with citric acid. When the fruit is finally treated in the acid bath it will lose a large amount of colour, which can be restored by adding more colouring to secure the proper shade.

When the candying is done separately after the colouring, many ways of introducing syrup are used. A 36° Bé. syrup is add to the barrel when a cold process of sugar curing is followed, and then the barrel is rolled around a few times and allowed to stand for about seven days. At the end of this period the Bé. reading will be reduced to about 20°. The syrup is then drawn off and reinforced to its original strength by adding sugar. This in turn is allowed to stand till the Bé. is reduced to about 22°.

Pickle Troubles.

1,466. *We have recently opened a pickling department, but during experimenting have encountered a few snags and should be glad of your advice. Two or three weeks after bottling, contents become cloudy, and, in the case of the mixed pickles, sometimes ferment and give off a nasty odour. In addition, our piccalilli will often turn dark and discoloured at the top and sometimes become watery.*

Our methods are as follows: Brine for at least three days in tubs containing 2½ buckets of salt to 40 gal. of water; wash with fresh water, drain for 12 hours, then pack in bottles, adding pure vinegar and pure spice. The piccalilli contains flour, sugar, mustard, turmeric, cayenne, acid, and water, boiled until thick (the amounts used were quoted). (England.)

Our observations cannot be more than purely general. To be otherwise would require more information on several points. By far the best plan is to get a qualified man (recommended) to go into the matter on the spot.

The clouding and apparent fermentation of your pickles may result from several causes.

1. It may be due to actual fermentation arising from using a vinegar of poor keeping properties.

2. It may be fermentation caused by the vegetables, owing to inadequate cleaning.

3. It may not be fermentation at all, but a chemical action between the vinegar and certain substances in the vegetables which have not been removed by the brine, or impurities in the salt used. This is a frequent cause of "gassing" and clouding in pickles. An examination of a sample of the pickles would prove which of these causes is operating.

The discoloration of the piccalilli is probably due to metallic contamination. The occasional watery condition of the piccalilli is probably due to over-boiling, and the use of the gum would help.

There are one or two points which might help if you can give information about them.

You speak of 2½ buckets of salt. How many pounds does this represent and what kind of salt do you use? Also, the vegetables after brining and washing should be soaked overnight, or at any rate between 24 and 36 hours, in a 4½ per cent. solution of acetic acid before filling.

What about cauliflowers, are these brined twice? The flour should be made into a thin batter with cold water, and run into the pan while simmering. That is to say, for the preparation of a liquor, all the ingredients except the flour and vinegar are put into a covered pan, and gently simmered for about 30 minutes. The batter is added and stirred while boiling until the mixture thickens. Cut off the steam and add the vinegar while stirring. Then run the product through a fine sieve.

Cream Stabilisation.

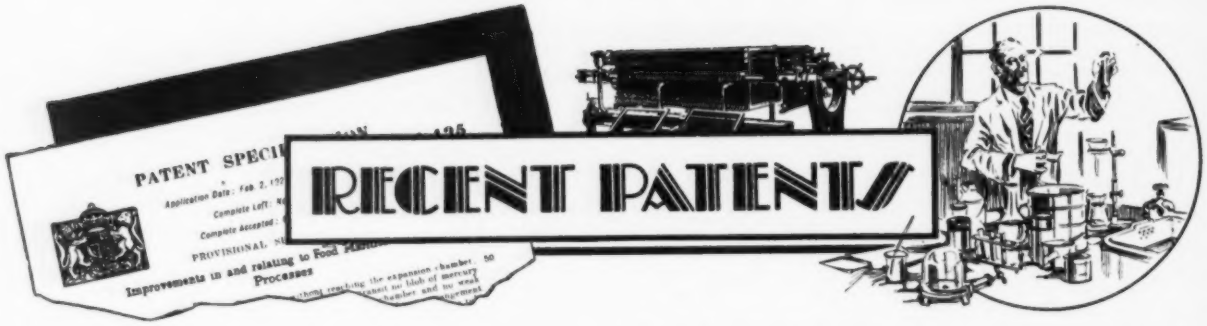
1,467. *Kindly discuss the stabilisation of cream in connection with canning.* (British Isles.)

Probably the chief factors affecting the stability of the emulsion are (*a*) preheating, (*b*) homogenising, and (*c*) addition of salts.

Preheating is an important process, as it appears that certain physical changes affecting coagulation should take place before the process of homogenising. The preheating temperature recommended is generally 70° to 80° C.

Homogenising very largely prevents the fat separating out at a later stage, but it decreases the heat stability and renders the cream more liable to what is known as "fat clumping" and "feathering." The best homogenising pressure is about 3,000 lb. but, apparently, still better results can be obtained if the cream is subsequently re-homogenised at about 1,000 lb.

In regard to the addition of salts, sodium citrate, disodium phosphate, and sodium bicarbonate have all been used with success. Apparently, the function is more to counteract the influence of calcium than for any other purpose, although possibly alteration of *p*H may have something to do with it. It has been said that the quantity of sodium citrate used is about 0·1 per cent. and this increases the heat stability, although it tends to make the cream a little thinner. As far as the other substances such as Irish moss, gum tragacanth, or extract of locust bean are concerned we do not know whether these have been tested or not, and it would be difficult to say whether they would be of any real value as the problem is a very complicated one. It has been found that increasing the total solids by the addition of skimmed milk powder may be of advantage in some cases, but in other cases it apparently reduces the head stability. The Public Health Regulations should be read carefully.



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Published Abstracts

Group Abridgments can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C. 2, either sheet by sheet as issued on payment of a subscription of 5s. per group volume, or in bound volumes price 2s. each.

Conversion of Liquid Food Products into Powder Form. With a view to overcoming the drawbacks bound up with existing methods of spray drying of milk and other liquid foods, including the variability in grain size and the necessity for using large chambers so as to prevent the sprayed liquid from touching and sticking to the walls, it is proposed to introduce the liquid by a centrifugal spraying device into a heated stream of air or gas. The dried powdered particles of milk powder are carried upwards through the spraying chamber owing to an arrangement whereby the heated stream of air is made to move upwards. This arrangement also ensures regular and effective drying of the particles and enables a considerable reduction to be made in the size of the spraying chamber. (Patent 396,579.)

Baking System for the Maintenance of Bread in the Fresh Condition. Staleness in bread develops not only as a result of desiccation, but also as a consequence of a whole series of changes. Mention may be made, for example, of alteration in the distribution of moisture between different parts of the same bread or between different constituents of the flour; diastatic action; surface mould formation; internal alcoholic or other fermentation. The baking procedure adopted with a view to counteracting these changes and thus maintaining the baked loaf in the fresh condition for a comparatively long period is based upon the incorporation of the dough with a hygroscopic substance, and is illustrated by the following example. The ingredients of the loaf are:

White wheat flour	100·0 kg.
Common salt	1·5 kg.
Water	50·0 litres
Sugar	2·5 kg.
Yeast	3·0 kg.
Pure glycerine	1·0 litre

Part of the water is first mixed with the flour, the remainder being incorporated after raising the temperature to 40° C., This is followed by addition in aqueous solution of the salt, sugar, and glycerine, when the mass is kneaded in the usual manner. A preliminary fermentation is undertaken for 80 minutes at 35° C., and is followed by further kneading prior to a second fermentation period of 25 minutes at the same temperature. After further kneading, the dough is distributed into cans which are only half filled and fermented for 25 minutes. At this stage, the cans are covered over but not completely sealed (this is an important feature of the process) and baked in an oven for 45 minutes at 240° C. in the case of 75 gm. boxes. They are then removed and completely sealed without any delay by clinching and automatic counter-soldering. The tins are then heated to 170° C. for a time and finally allowed to cool at such a rate as to reach atmospheric temperature after 5 hours. Before use, the cans are heated for 15 minutes at 100° C., when the bread removed from the boxes will maintain a freshness for a long time. (Patent 396,634.)

Increasing the Ergosterol Content of Yeasts. Considerable attention is being devoted to the problem of cultivating yeasts in such a manner as to produce a richer yield of ergosterol. Normally, *S. Cerevisiæ* and allied organisms contain about 0·4 per cent. of ergosterol (the parent substance of vitamin D). One of the earlier methods, which was successful in approximately doubling the yield, involved incubating the yeast without growth in an aerated medium containing carbohydrates and phosphates. Quite a different approach to the problem is now announced (British Patent 396,206) in a method whereby the organisms are exposed to oxidising action whilst being partially deprived of their customary nitrogenous nutrient. For example, nitrogenous salts in quantity smaller than normally required by yeast are added in the early days of fermentation, and the organisms are exposed after growth to the action of oxygen or air. A somewhat higher temperature than is usual for yeast propagation is stated, in conjunction with the afore-mentioned treatment, to favour a higher yield of ergosterol. Compared with the average figure of 0·4 per cent., the process has succeeded in raising the ergosterol content of yeasts up to as much as 1·19 per cent.

Alternative Sources of Vegetable Protein. Among the cheap sources of vegetable nitrogenous nutrients, a first place is held by wheat gluten, which is also in extensive use as an ingredient of adhesives and sizes. Interest must therefore be aroused by the discovery of another plentiful source of gluten in the carob bean tree (*Ceratonia siliqua*). As set forth in a recent patent (396,150), the seed kernels of the carob bean tree or allied plants are husked and extracted with warm water to isolate the germinal substance, which is then dried at a moderate temperature (40° to 50° C.) or, alternatively, in a vacuum or in a warm air current. A paste of the ground germinal substance with water is then freed from cellulosic matter and green colouring matter by prolonged kneading under water. There remains a flexible mass with a mother of pearl lustre which is apparently indistinguishable from wheat gluten itself except for the somewhat darker colour.

JAPANESE TUNA PRODUCTION

It is estimated by the trade that production of canned tuna in Japan during 1933 will amount to between 400,000 and 450,000 cases, according to a report to the Department of Commerce, Washington, submitted by Assistant Trade Commissioner H. B. Titus, at Tokio. There are now some seventeen canning plants operating, and it is reported that as many as twenty new plants are under construction or contemplated.

Reports in trade circles, however, indicate that some of the smaller packers are not in good financial condition, and there is considerable question as to the ability of some of the packers now establishing canning plants to produce, owing to financial shortages.

Exports to the United Kingdom during 1932 totalled some 120 cases, as compared with the total exports of over a quarter of a million cases.